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EXPERIMENT STATION RECORD,

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With the coöperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

LIST OF STATION PUBLICATIONS ABSTRACTED.

LIST OF UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS ABSTRACTED.

EXPERIMENT STATION RECORD.

VOL. VII. No. 1.

The favorable report of Mr. P. G. Craigie to the Board of Agriculture of Great Britain on the experiment stations and agricultural colleges of the United States, recently published, is gratifying and encouraging to workers in these lines. Mr. Craigie visited this country in 1893 as a representative of the Board of Agriculture. He made a personal inspection of a number of the experiment stations, and, rather incidentally, as he says, a number of the agricultural colleges. He studied the history, organization, work, and aims of the stations, and their methods of getting the results of their work before the farmer. The report contains very complete and accurate information in regard to the experiment station movement in this country, with descriptions of the outfit and work of stations visited, and a catalogue of the station publications for 1892 and 1893.

The writer appears to appreciate the important work the stations are doing toward the improvement of farm practice, as well as the efforts they are making to keep in touch with the farming community and to educate the farmer. While he doubts the advisability of requiring four bulletins annually from each station, his comments on the publications of the stations are on the whole very favorable. In reference to the annual report of one of the stations, which he outlines quite fully, he says that "the annual record of this station's work is itself a lesson well worth attention in other countries if only for the mode adopted of bringing under the notice of agriculturists in a clear and attractive form a long series of results and suggestions by eminently practical inquirers, from the opening chapter on the manufacture of pork, to the tables and colored diagrams dealing with the chemical comparative and relative digestible matter in the various feeding stuffs of America."

His verdict in regard to the station movement as a whole is perhaps best shown by the following extract from his report: "Without maintaining that there are no grounds for occasional criticism of the methods employed in the large number of rapidly organized stations, and without asserting the equal quality of the whole of the experimental work, I confess that I returned from my journey inclining to the belief that in the institution of these stations a hopeful beginning had

been made. The total number of stations, 54, while at first sight large, is not after all by any means an excessive proportion for the vast area —as large as all Europe—which they serve. Good advice and many practical hints have been given to the farmers of the Union, and more could perhaps be done with greater continuity of system if the central office had more direct control over local work. But it is undeniable that good results must attend the cultured thought which is being turned on agricultural problems."

He believes that the stations are doing much work which is of undoubted interest in Great Britain, and that it is important to follow up this work in view of the "possible development of agricultural competition which the lessons of transatlantic experiment stations may suggest."

The Sixth International Veterinary Congress, to be held at Berne, Switzerland, September 16 to 21, promises to be an interesting one to veterinarians and all interested in the detection and control of disease in domestic animals. The first question for discussion relates to the international veterinary police, and includes a proposition for the holding of an international convention to consider the transportation and inspection of animals. In this connection the publication of an international bulletin on contagious diseases of domestic animals is to be considered. The diagnostic value of mallein, tuberculin, and pneumobacillin, the inoculation against symptomatic charbon and tetanus, and against rouget and pneumo enteritis of swine, will be discussed; also the question of the relation of food materials from tuberculous animals to public hygiene, and the influence of veterinary science on social development and on the increase of public wealth. The means of combating contagious pleuro-pneumonia in different countries will receive considerable attention. On this subject the American reporter is President A. Liautard, of the American Veterinary College in New York. A special section on anatomy will be formed, and its first subject of discussion will be the unification of anatomical nomenclature.

The list of reporters on the various subjects contains the names of veterinarians from most of the European countries. It is hoped that some account of the doings of this congress may be reported later.

THE DARMSTADT EXPERIMENT STATION.

J. B. LINDSEY, PH. D.

In the following pages a description is given of the organization, equipment, and work of the experiment station at Darmstadt, in the Grand Duchy of Hesse. Under the directorship of Dr. Paul Wagner this station has become of widespread interest.

ORGANIZATION.

The first steps were taken to organize this station by the general secretary of the duchy, who called a meeting of all agriculturists interested at Frankfort on the Main in November, 1869. Another meeting was held the following May, and as a result, encouraged by the Government, substantial support was secured, and a board of control selected. Dr. Ernst Schulze, at present professor of agricultural chemistry in the polytechnic school at Zurich, was chosen director. In May, 1871, the laboratory was completed, and actual work began. At this second meeting the desire was expressed that the object of the station should be first and foremost to exercise a control over the sale of fertilizers, fodders, and seeds. It was also desired that the station should be ready with advice and counsel to farmers, in accordance with the latest teachings, so far as possible on all important agricultural topics, and further that it take up such special lines of investigation as might prove to be of interest to the great body of agriculturists.

At the outset the station was controlled by a variety of interests which prevented the utmost harmony, but in 1874 a reorganization took place. The present governing board consists of two representatives from each of the three agricultural societies of the duchy, together with Economic Counselor Müller, who represents the Government.

STAFF.

In 1872 Professor Schulze was succeeded by the present director, Prof. Paul Wagner. Dr. R. Dorsch has been connected with the station for a number of years as first assistant. In 1892 these two gentlemen published the first extended description of the results obtained in the special line of inquiry pursued at the station, under the title of *Die Stickstoff-Düngung der landwirthschaftlichen Kulturpflanzen* (The nitrogen manuring of agricultural crops). The other assistants are Dr. Matz, Dr. Wellhäuser, and J. Aeby. Besides these, a helper is

employed in the laboratory and several workmen in the experiment garden, one of whom has been connected with the station for a long time, and is able to render valuable and intelligent assistance in the care of the outdoor experiments.

REVENUE.

In 1877 the income of the station was stated as follows:

From the government	$700
From agricultural societies	625
Regular fertilizer analyses	550
Fodder analyses	75
Other paid analyses	500
Total	2,450

Its present regular source of income amounts to:

Government aid	$5,000
Analysis fees	4,250
Total	9,250

GENERAL EQUIPMENT.

The station was first established in three rooms fitted up for laboratory and office purposes in a private house in the city. Its first work was practically all of a chemical nature. Its rapid growth, however, demanded increased facilities, and in July, 1877, it was removed to its present location. The land occupied by the buildings and garden of the station is in the form of a parallelogram, having a frontage on the roadway leading from Darmstadt to Griesheim of 233 ft., and extending back to a depth of 600 ft., making about 3¼ acres in all. On the grounds is a dwelling house occupied by the director, and connected with this at the rear is a large wing used as a chemical laboratory. These buildings are of brick. In front and to some extent to the north of the dwelling is a small park.

The laboratory building, one and one-half stories high, is 45.5 ft. wide and 75 ft. long. It has three entrances, one to the south, one to the west leading to the experiment garden, and a third opening into the dwelling house. As one enters at the south door, the first room to the left (furnace room) is occupied by a large still with water baths and drying closets attached, and the two small rooms to the right are for storage and general purposes. The large laboratory room is 29 ft. wide by 37.5 ft. long. Opening out of this room on the north are several small rooms, used for potash and nitrogen determinations, balance room, and for office purposes. One of the two rooms on the eastern side of the large laboratory room contains the station library and the other is occupied by the director as a private study. The room above the laboratory is used for storage. The laboratory is conveniently arranged and well equipped with all apparatus necessary for the work undertaken.

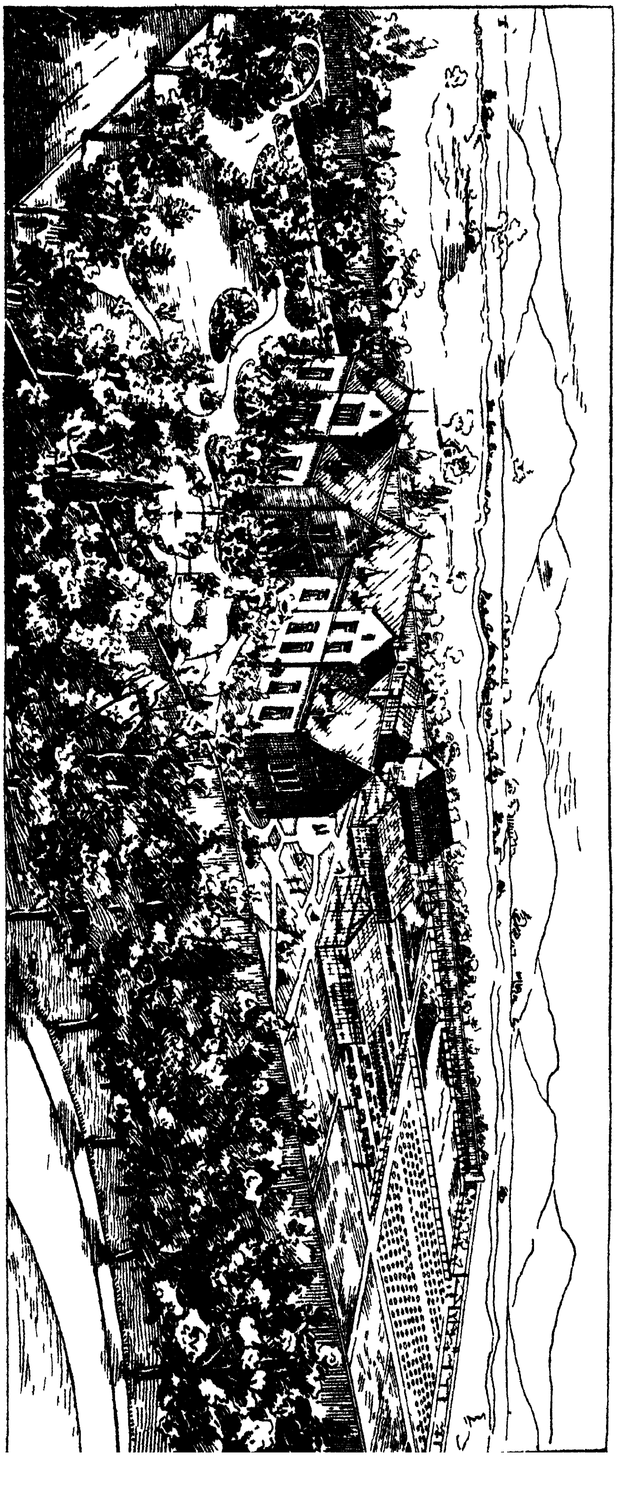


Fig 1.—General view of the Darmstadt Experiment Station.

The experiment garden is in the rear of the house and laboratory. To the south, on a line parallel with the laboratory, is situated a green-house 16.5 by 41 ft.; immediately to the west is a shed inclosed on three sides, and directly beyond in the same line are several pits made of masonry, used for the special purpose of preparing soil for the various experiments.

Directly in the rear of the laboratory are the upper and lower experiment gardens proper. The upper garden is 169 ft. long and 68 ft. wide, and is divided by a roadway some 13 ft. wide from the lower garden, which is 120 by 68 ft. The upper garden is filled with tracks on which the wagons containing the pots are run. A number of stationary tables are placed between the lines of track, on which the vegetation pots can be set in pleasant weather, thus preventing too much crowding on the wagons after the plants are considerably developed. At the eastern end of the upper garden are situated two glass houses for the protection of the pot experiments during bad weather. These are each 23.5 ft. wide by 49 ft. long. The doors at the ends (eight in number) open outward, allowing the entrance of 6 tracks. Fifteen movable windows are arranged in the top and sides for ventilation. Each glass house cost, including foundation, about $1,000.

The shed on the south side of the grounds, just outside the garden proper, is 55 ft. long and 27½ ft. wide, and is inclosed on three sides, the open side facing the garden. It is used to protect the various soils during the process of sifting and mixing.

The lower garden is devoted exclusively to large cylinders sunk into the earth. To the north and west of the experiment gardens proper are plats for a family vegetable and flower garden, together with several plats where certain special experiments are conducted.

WORK OF THE STATION.

CONTROL WORK.

The station exercises control over the sale of fertilizers, feeding stuffs, and seeds. During the year 1893 the following samples were examined.

Fertilizers	2,405
Feeding stuffs	659
Seeds	380
Special plant analyses, soils, etc	111
Total	3,555

In 1887 the total number of samples examined was 2,373, showing in 6 years a very marked increase.

The method of fertilizer inspection differs from the one generally in vogue in the United States, in that the cost of analysis is paid directly either by the farmer or manufacturer. The experiment station makes

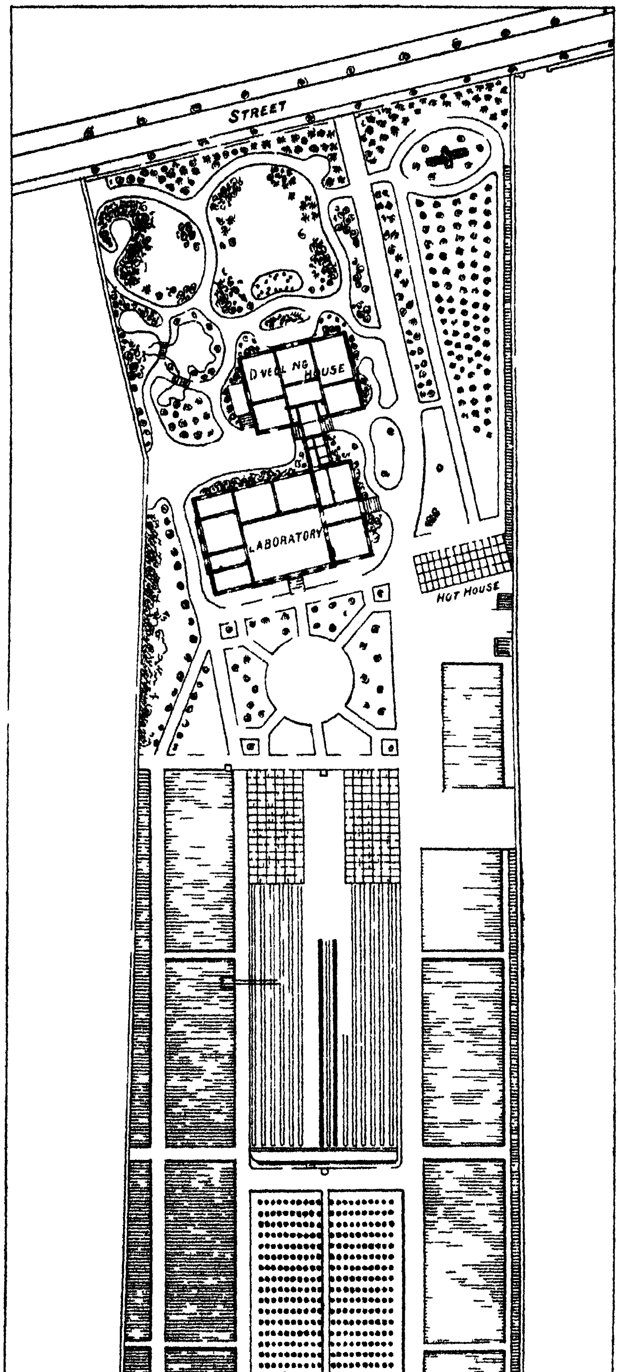


Fig 2—Ground plan of station

a contract with all the large firms doing business in the duchy, whereby every purchaser of fertilizer to a certain amount has the privilege of sending samples to the station for analysis, free of cost. The fertilizer is often paid for on the basis of the results of analysis. The director of the station or his deputy has the privilege of inspecting the goods at any time during the process of manufacture and also the finished products offered in the markets, and of publishing the results. In case a farmer of the duchy desires an analysis of goods purchased from a firm under the control of the station he must pay the regular analysis fee, less 50 per cent discount, which the State guarantees by a yearly deposit with the station of $5,000. The tariff rates are briefly as follows:

Fertilizers and feeding stuffs—soluble phosphoric acid, $1.50; potassium oxid, $2; nitrogen, $1.25; moisture, $0.50; ash, $0.50; cellulose, $1.50; fat, $1.25; starch, $2; microscopic examination of feeding stuffs, $1; seeds, $1 to $1.50; water (ordinary analysis), $2.50; milk (total solids and fat), $2.

In addition to its control work the station carries on a very large correspondence with farmers concerning a great variety of agricultural matters, and numerous special investigations. It is to the latter that the chief interest attaches.

SPECIAL INVESTIGATIONS.

In 1880 Professor Wagner published in the *Journal für Landwirtschaft* an article entitled *Zür Begründung und Ausbildung einer exakten Methode der Düngungsversuche* (An effort to establish and perfect an exact method to determine the effect and value of different forms of plant food). In this article he called attention to the vast number of experiments that had been made, and the comparatively few results that had been secured. He pointed out that although we had for a long time known that nitrogen, phosphoric acid, and potash were necessary for plant growth, it seemed impossible to answer from the results of field experiments many important questions in regard to the use of these materials which farmers were asking. For instance, (1) What forms of phosphoric acid or potash are best for certain crops, on different soils, under different climatic conditions, etc.? (2) For what plants and in what soils can nitrate of soda, sulphate of ammonia, blood, Peruvian guano, etc., best be used? (3) In what quantities and proportions are the phosphoric acid, nitrogen, and potash to be used? (4) At what time and how deep are the different fertilizers to be applied?

OBJECTIONS TO FIELD EXPERIMENTS FOR EXACT INVESTIGATION.

According to Wagner, field experiments covering areas of from one-tenth to one-half of an acre can not give sufficiently accurate results. Neither is it possible, in his judgment, to secure results that are to be relied upon from experiments conducted in small beds, even when the

greatest precautions are taken. The reasons therefor may be briefly mentioned:

(1) A field or garden bed is very difficult to find in which all of the soil is of the same mechanical condition and of the same degree of fertility. Parts of such a field or bed will very frequently give smaller or greater yields than other parts.

(2) It is scarcely possible to secure exactly similar areas for each of the plats, and to fertilize, seed, and harvest them all alike, especially when there are large numbers of plats and the work must of necessity be done by several different farm hands.

(3) Many unavoidable sources of error arise, not the same on every plat, from lack of moisture, insects, birds, etc.

(4) The increase of crop resulting from the fertilizer applied is in many cases too small in proportion to the errors involved. Especially is this the case with phosphoric acid and potash. All the field and bed experiments thus far described show greater differences in the parallel experiments than between the fertilized and unfertilized plats.

(5) The fact that in order to decide a point in many cases the increase of crop must be the result of but one influence and not of several, renders the field experiment a very uncertain method of investigation. For example, it would be very difficult by the field method to study the influence of a sand and clay soil upon the availability of a certain form of plant food, because both of these soils are not liable to be found sufficiently near to each other to be governed by the same climatic influences.

(6) In field and bed experiments one is entirely dependent upon the condition of the soil, subsoil, and moisture as they happen to exist, and very often it is hardly possible to secure any number of plats where these conditions are of a similar character.

(7) When one series of experiments is completed, one is obliged to wait several years until the plats can be brought into the right condition to start another series.

Wagner has tested the value of large and small plats of ground for the carrying out of exact fertilizer experiments, and concludes that the results of such experiments are in no way to be depended on, when looked at in the light of scientific research. In scientific experiment it is absolutely necessary that the investigator be able to control *all conditions* that have any bearings on the results.

One should not, therefore, from the results obtained with field experiments attempt to answer the many difficult problems concerning plant nourishment, but should depend upon the results obtained from more exact investigation.

Field experiments, on the other hand, have their place. They should be used to give information concerning local conditions, concerning the practical value of different crops, concerning the peculiarities of particular soils, etc. Field experiments should show the farmer whether the teachings of science can in all cases be turned to practical account.

WAGNER METHOD.

To overcome the many adverse conditions encountered with field experiments Professor Wagner has given a great deal of time and study to the development of the pot culture method. To carry out this system of investigation large cylinders open at both ends are sunk into the earth to the rim of the cylinder. The soil inclosed in one of these cylinders corresponds in a sense to a field plat, but with this distinct advantage that all the conditions can be controlled. The soil in each cylinder can be thoroughly mixed, and exactly similar conditions can be had, in so far as layers of earth, depth of surface soil, the quantity and distribution of fertilizer, seeding, depth of seeding, and number and distance of plants from each other, are concerned. These miniature plats are separated to a considerable depth from one another, and the cylinders can be filled with any kind or condition of soil and subsoil. When a series of experiments is ended the soil can be removed, the cylinders refilled, and another series started without delay. Such experiments are entirely independent of rain, for during a drought they can be supplied with water. Each cylinder takes up so little room that it is possible to have a very large number of experiments in operation at the same time.

By this method of investigation questions can be answered with much greater accuracy and rapidity than with field or garden experiments.

In addition to these cylinders water tight pots are also used. The largest of these pots are placed upon wheels which run on iron rails, while the smaller ones are transported on wagons, which also run on rails. Such pots can be removed for protection against storms or low temperature into well ventilated glass houses. Both the cylinders and pots fulfill all the necessary conditions.

Professor Wagner has labored industriously to build up and perfect this method—now known as the Wagner pot culture method[1]—and to study the manifold problems, both scientific and practical, relative to the physiological and economical value of nitrogen, phosphoric acid, potash, soda, and lime, and their effect upon the growth of a great variety of agricultural plants. Some of the problems under investigation by the pot method may be mentioned.

SAMPLE PROBLEMS UNDER INVESTIGATION.

The ultimate aim of a rational system of fertilization is to obtain the largest yields of the best quality of all kinds of farm and garden produce.

In order to attain such an end the following ideas must be kept constantly in view:

(1) The most necessary forms of plant food, namely, phosphoric acid, potash, and nitrogen, must be purchased at the lowest possible cost.

[1] A description of the details of the Wagner method will be given in the next number of the Record.

This statement leads us to a consideration of many important practical questions. Are there, for example, crops and soils upon which the cheaper forms of phosphoric acid, as found in Thomas slag and South Carolina floats, can be used to advantage? Which plants can utilize the Thomas slag to the best advantage, and what chemical and physical conditions of the soil are most suitable to obtain the best results from the undissolved natural phosphates? Are there conditions where the various forms of cheap organic nitrogen as found in the poorer qualities of tankage in wool, horn, and leather shavings can be turned to account, and what soil conditions favor a rapid decomposition of such manures?

(2) Plant food must be applied in sufficient quantity to obtain profitable yields.

This would open the question as to how the natural ability of the soil to furnish nourishment should be measured, and if there are some plants that are able to take more potash, nitrogen, and phosphoric acid from the soil than others.

(3) The plant food must be applied in the form and proportion best suited to the particular crop to be grown.

Nitrogen, phosphoric acid, and potash are to be had in a variety of forms. Which of these forms, taking into consideration soil conditions and plant individuality, are best suited to produce the best results? In what proportion to each other should the nitrogen, phosphoric acid, and potash be applied? Should a fertilizer rich in nitrogen, phosphoric acid, or potash be used to attain the end sought?

(4) Those crops should receive the most extensive culture which make the greatest pecuniary returns for the plant food applied.

This leads one to inquire into the number of pounds of grains, roots, etc., that can be obtained from one pound of nitrogen, phosphoric acid, or potash. Is it possible to enable many or all of the various farm and garden crops to most thoroughly utilize the most costly element of fertility—the nitrogen—by manuring with an excess of phosphoric acid and potash?

(5) The conditions must be such as to enable the plant food to do its best work with the least loss.

What are the most favorable conditions? How much influence has porosity of soil, lime, and humus upon the availability of the different forms of plant food? Is an excess of soluble phosphoric acid over that taken up by the plant lost by going over into an insoluble form? Can plants growing upon soil fertilized with an excess of phosphoric acid and potash take more of these ingredients than are necessary for their complete development?

In addition to the pot experiments several hundred field experiments are carried on by different farmers under the direction of the station. The object of the field experiments is to test the needs of various soils, and further to see if the facts obtained from the experiments with pots have in all cases a practical application.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The Seventh Annual Convention of the Association of German Agricultural Experiment Stations (*Landw. Vers. Stat., 45 (1894), No. 5 and 6, pp. 325-393*).—The seventh annual convention of this association was held at Dresden, September 21 and 22, 1894, F. Nobbe presiding. Fifty-five members and guests were in attendance. After a brief review by the presiding officer of the work of the year, the form of contract between fertilizer manufacturers or dealers and the experiment stations exercising official fertilizer control was discussed and modified so that the limits of variations from the guaranty are fixed at 0.4 per cent for water-soluble and insoluble phosphoric acid and potash and 0.2 per cent for nitrogen. Two important changes in the statutes providing for the adjudication of differences between dealers and purchasers of fertilizers were recommended, one in the composition of the arbitration commission, and the other fixing the general charge for examination of each sample at 10 marks. The association then took up questions referred from the previous meeting.[1]

The resolutions providing for participation of representatives of the German Fertilizer Manufacturers' Union in the deliberations of the association and regulating the examination and valuation of fine meal and phosphoric acid in slags were adopted without debate.

As regards determination of nitrogen in nitrate of soda the regulation finally adopted simply provides that nitrogen shall be determined by direct methods.

The method of examination of feeding stuffs proposed at the previous meeting was modified so as to read: The qualitative examination of feeding stuffs for sand as well as mineral adulteration is made obligatory, and when the preliminary test indicates the presence of more than normal amounts a quantitative examination is to be made.

A. Emmerling, to whom the subject was referred at the previous meeting, presented a paper on the value of carbohydrates, in which he tabulated the market price and protein, fat, and carbohydrate contents of a large number of feeding stuffs, and from this data reckoned the commercial value per kilogram of the carbohydrates which they contain,

[1] E. S. R., 6, p. 9.

as well as the relative value of the protein, fat, and carbohydrates. The method of reckoning the value of carbohydrates by difference is condemned, since it indicates that the value of carbohydrates in grains is more than double that of brans and other mill products. It is true that there is a preference among feeders for certain grains, but it is manifestly unjust to value the protein in both cases at the same price, and the carbohydrates of the grain at a so much higher rate. It is also unfair to assume that the low market price of the by-products affects only the carbohydrates. The author therefore believes that a method of valuation should be employed in which the variations in market price affect all consituents alike. Such a method is most safely based on the relative fuel value of the carbohydrates and fat. On the basis of the figures reported the author recommends that in the valuation of feeding stuffs the ratio of the constituents should be, protein 3, fat 3, carbohydrates 1. After discussion of the paper the subject was referred to the section on feeding stuffs for further investigation.

Reports are given of coöperative determinations of phosphoric acid in pure potassium phosphate by the ordinary and Neubauer molybdic methods and by the citrate method; nitrogen in ammonium chlorid and potassium nitrate by the Kjeldahl, Kühn, Ulsch, and other methods; and potash in pure potassium sulphate and crude Stassfurt salts by the Fresenius and Stassfurt methods in 27 laboratories.

The agreement of results by the ordinary molybdic method for phosphoric acid was very close, the error being only $\pm$ 0.1 per cent in 23 determinations of phosphoric acid in a phosphate containing 15 per cent of soluble phosphoric acid. The results by the Neubauer method were not so concordant, but this was no doubt partly due to variations in the details of the method by individual analysts. It was observed that when Neubauer's directions were strictly followed there was a loss of phosphoric acid on long-continued ignition at a high temperature, but this was prevented by the use of a magnesia-covered crucible lid. The use of a constant correction is, however, deemed of doubtful advisability, since the results reported indicate that the error is likely to vary widely or entirely disappear with different methods of manipulation. This point is to be further investigated. The citrate method tested by about 10 chemists gave closely agreeing results, which fully confirm those of previous investigations. The section on fertilizers recommended provisionally that in control analyses only a thoroughly tested modification of the molybdic method should be employed for the determination of phosphoric acid.

In view of the results obtained in the determination of nitrogen the convention recommends that nitrogen in ammonia salts and in ammoniated fertilizers be determined by distillation with magnesia instead of soda. In all samples designated as "ammoniated superphosphates" only the nitrogen in the form of ammonia is to be determined unless the determination of total nitrogen is especially requested. In order

that there might be no confusion on this point the section on fertilizers was instructed to consult the German Agricultural Society with reference to classing all fertilizers which contain both organic and ammoniacal nitrogen under the name "ammonia-nitrogen-superphosphates." In fertilizers containing organic nitrogen, total nitrogen is to be determined by digesting 10 gm. according to the Kjeldahl method, using an aliquot part of the solution for distillation.

The results of determinations of nitrogen in cotton-seed meal, digesting for 5 to 20 hours, show a steady increase in the per cent of nitrogen obtained as the length of the period of digestion increased. In view of this fact the convention recommended that further investigations as to the length of time of digestion of nitrogenous feeding stuffs with sulphuric acid alone, and with an admixture of phosphoric anhydrid be carried out by the association.

In the determination of potash the results were very discordant, especially so for the crude Stassfurt salts (greatest variation, 1.63 per cent). The Stassfurt method gave much higher results for the crude salts than for the pure sulphate, and in every case higher than the Fresenius method. Some results reported by the experiment station of Marburg indicate that the strength of alcohol used in washing the chlorid has a decided influence on the percentage of potash obtained. With 96 per cent alcohol, 14.08 per cent of potash was found; with 85 per cent alcohol, 12.95 per cent. It was recommended that the methods be further tested on a crude Stassfurt salt (preferably kainit), carefully selected, dried, and prepared for analysis.

The report of the section on the valuation of Thomas slag details the results of investigations of the relation between the citrate solubility of the phosphoric acid and the fertilizing value of the slag as determined by vegetation experiments. The results of 16 experiments with slags containing from 8 to 24 per cent of phosphoric acid show that in every case there was a close agreement between the citrate solubility and fertilizing effect. On the basis of the results thus obtained the following classification of slags was proposed:

50 per cent or less of phosphoric acid soluble in citrate	bad.
60 per cent soluble in citrate	medium.
70 per cent soluble in citrate	average.
80 per cent soluble in citrate	good.

Wagner briefly discussed the results of his work in this line, and Märcker gave an account of experiments at Halle with 9 samples of slag containing different amounts of silicic acid, which indicate that, as Wagner and Hoyermann[1] maintain, there is, within certain limits, a relation between the silicic acid content and the citrate solubility.

The recommendation of the committee that the valuation of Thomas slag be based on the determination of citrate solubility by means of the Wagner method, using the molybdic method for determining phosphoric acid in the solution, was adopted by the association.

[1] E. S. R., 6, p. 624.

A brief review of tests of different methods of examining superphosphate-gypsum—extraction with strong alcohol, exhaustion in a continuous extractor with alcohol or ether, and titration of a water extract, using methyl orange as an indicator—is given, but the results were so unsatisfactory that the subject was referred to the section for further investigation.

As regards the question of international coöperation in the investigation of analytical methods for fertilizers, feeding stuffs, and seeds proposed by the Association of Official Agricultural Chemists of the United States, the opinion was expressed that while the importance of such coöperation was fully appreciated it was not practicable for the German association to take part in such work at the present time.

F. Nobbe submitted a report on the determination of the value of grass seed, in which he proposed for the examination of the smaller grass seeds (Poa, Agrostis, Dactylis, Alopecurus, etc.) the following substitute for previous methods: An average sample is taken in the usual manner, and foreign seeds, dirt, and chaff removed. Of the sorted seed two smaller average samples, each containing about 300 to 400 perfect seeds, are taken. In case of Dactylis, *Festuca ovina*, and Alopecurus, 0.6 gm. is sufficient; of Arrhenatherum, 1.25 gm.; and of Poa, 0.2 gm. Both of these smaller samples are weighed and then soaked from 6 to 15 hours in distilled water. By this means empty, or, as frequently occurs in Alopecurus, thrips infested glumes are very easily detected and removed. The perfect seeds thus separated are tested in a seed bed in the ordinary manner, the results being reckoned to 1 gm. The wet empty glumes are dried at 30 to 40° C. and their air-dried weight is reckoned as foreign matter. The small loss due to the soaking may be neglected. Perhaps a constant correction of 1 per cent of their air-dry weight may cover the error from this source. The association unanimously adopted this method, as well as that which provides that at the conclusion of the germination tests of Coniferæ the seeds which fail to germinate shall be cut open and a record made of the number which are empty, decayed, and "apparently fresh."

New chemical apparatus, H. A. HUSTON (*Indiana Sta. Bul. 54, pp. 7, pls. 2, fig. 1*).—Illustrated descriptions are given of a machine for treating solids with liquids under uniform conditions, and a mechanical precipitating and stirring apparatus.

The first consists of a wheel to the rim of which are attached stoppered flasks containing the substance to be treated and the liquid. The wheel is made to revolve by an electric or water motor, and if other than room temperature is desired for the treatment the whole apparatus is immersed in water contained in a large galvanized tank, the water being heated to the desired temperature by injecting steam or by burners under the tank. The apparatus has been tested in the digestion of nitrogenous materials with pepsin solution, and in

the treatment of phosphates with ammonium citrate. Some results obtained with and without this apparatus are tabulated.

"In comparing duplicates the results from the use of the wheel are found to be subject to less variation than those from the usual method.

"The machine has proven very useful in a large amount of work on solubilities of various phosphates. . . .

"So far as it has been tested, it has proven very satisfactory in constancy of results obtained, in ease of manipulation, and especially in requiring no attention during the interval between placing the flasks in the apparatus and removing them at the end of the required time, thus permitting the chemist to engage in other work during the entire interval."

The mechanical precipitating and stirring apparatus provides for precipitating 12 solutions simultaneously, and the stirring apparatus is driven by a single belt. The precipitating solutions are placed in funnel tubes drawn out at the end so as to deliver one drop per second. The front of the apparatus is hinged and permits the whole to be closed when not in use or during precipitation.

"The apparatus has proven extremely satisfactory in precipitation of ammonium-magnesium phosphate. The precipitate is very crystalline, and where the stirring is continued for some minutes after the magnesia solution has all been added, no amorphous precipitate is observed on standing."

A modification of the method of determining citrate soluble phosphoric acid in Thomas slag, G. SANI (*Staz. Sper. Agr. Ital.*, *28* (*1895*), *No. 1*, *pp. 275*, *276*).—The following modification of Wagner's method is proposed, which is claimed to have the advantage of a great saving of time and reagents. Five grams of the substance is measured into a beaker with 100 cc. of water and saturated at boiling temperature with 10 per cent citric acid. Two hundred cubic centimeters of official citrate of ammonia is added and the solution heated on a water bath for an hour with careful stirring. The rest of the process is conducted as usual. In comparative trials on 2 samples of phosphates Wagner's original method and the above modification gave almost identical results.

Detection of abrastol in foods, BELLIER (*Monit. Scient.* (*4*), *9*, *pp. 191*, *192*; *abs. in Chem. Centbl.*, *1895*, *I*, *No. 16*, *p. 856*; *Chem. Ztg.*, *19* (*1895*), *No. 28*, *Repert.*, *No. 9*, *p. 102*).—Fifty cc. of wine is made alkaline with a few drops of ammonia, gently shaken for 2 minutes with 10 cc. of amyl alcohol (alcohol is added if an emulsion is formed), the amyl alcohol is decanted, filtered if turbid, and evaporated to dryness. The residue is thoroughly moistened with 2 cc. of a mixture of equal parts of strong nitric acid and water, heated on the water bath until half of the water is evaporated, and transferred to a test tube with the addition of 1 cc. of water. About 0.2 gm. of sulphate of iron is now added, and then an excess of ammonia, drop by drop, with constant shaking. If the resulting precipitate is of a reddish color, it is dissolved in a few drops of sulphuric acid, and sulphate of iron and ammonia is added as before. As soon as a dark colored or greenish

precipitate has been obtained, 5 cc. of alcohol is added, the precipitate is dissolved in sulphuric acid, and the fluid is well shaken and filtered. Pure wine gives with this method a colorless or light-yellow liquid, while a red color is produced in the presence of 0.01 gm. of abrastol. The author states that the method is also applicable to the examination of beer, sirups, and preserved food.

Fats should first be melted, extracted with hot 20 per cent alcohol, the filtered alcohol evaporated to dryness, and the residue treated as given above. Salicylic acid gives a more orange-colored liquid when treated in the same manner, and when this liquid is treated with a few drops of a very dilute ferric-chlorid solution the well-known violet reaction is produced, while abrastol gives a blue color with ferric chlorid, which disappears on heating. The natural coloring matter from the alkaline liquid by amyl alcohol, and anilin colors may be removed by evaporating to dryness with wool in the presence of acetic acid, when water will dissolve only the abrastol.—W. D. BIGELOW.

Action of magnesia mixture on glass, L. L. DE KONINCK (*Chem. Ztg., 19 (1895,) No. 21, pp. 450, 451*).—Magnesia mixture etched different kinds of glass to an appreciable but variable extent. Thuringian glass was more effected than Bohemian.

On a simple experiment for showing the presence of argon in the atmosphere, GUNTZ (*Compt. Rend., 120 (1895), No. 14, pp. 777, 778*).—Metallic lithium heated to a dull-red heat is used instead of magnesium to absorb the nitrogen.

The chemistry of chlorophylls, L. MARCHLEWSKI (*Die Chemie des Chlorophylls. Hamburg and Leipzig: L. Voss, 1895, pp. IV, 82*).

On the food fats, F. WALLENSTEIN and H. FINCK (*Rev. Internat. Falsif., 8 (1895), No. 9, pp. 159, 160*).

On the oxidation of tannin in cedar apples, L. LINDET (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 6, pp. 277–279*).

The action of permanganate of potash on various organic substances, E. MAUMENÉ (*Compt. Rend., 120 (1895), No. 14, pp. 783–785*).

Separation of the free acid of beeswax, T. MARIE (*Rev. Internat. Falsif., 1895, No. 8, p. 123; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., No. 11, p. 127*).

On the investigation of butter, C. T. MORNER (*Ztschr. analyt. Chem., 34 (1895), No. 2, p. 175*).

Investigation of the fat of corn meal, F. ROKITIANSKI (*Inaug. Diss. St. Petersburg, 1894; Pharm. Ztschr. Russland, 33, pp. 712, 713; abs. in Chem. Centbl., 1895, I, No. 1, p. 22*).

Further investigations on the separation of fat from the emulsion form in sterilized milk, RENK (*Arch. Hyg., 22, pp. 152–166; abs. in Chem. Centbl., 1895, I, No. 15, p. 798*).

On the analysis of gastric juice, J. WINTER (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 8, pp. 433–441, dgm. 1*).

Researches in chemistry and physiology, A. PETERMANN (*Recherches de Chimie et de Physiologie, vol. 2. Brussels: Mayolez, pp. 456*).—Among the subjects treated are sugar beets, composition of the atmosphere, the nitrogen question, assimilability of phosphatic slag, and composition of fertilizers and feeding stuffs.

On the determination of alcohol and of volatile acids, DUCLAUX (*Ann. Inst. Pasteur, 9 (1895), No. 4, pp. 265–280*).

On Hübl's iodin-addition method, J. EPHRAIM (*Ztschr. angew. Chem., 1895, No. 9, pp. 254–259*).

New applications of alkalimetry and acidimetry, F. HUNDESHAGEN (*Chem. Ztg., 18 (1894), pp. 505, 506, 547; abs. in Jour. Chem. Soc. London, 67–68 (1895), pp. 84,*

85).—Estimation of hardness of water and volumetric estimation of phosphoric acid by titrating the yellow precipitate.

Modification of the Reichert-Meissl butter process, C. BRÜNTE (*Chem. Ztg., 18 (1894), pp. 204–206; abs. in Jour. Chem. Soc. London, 67–68 (1895), p. 95*).

A new reaction for peroxid of hydrogen, BACH (*Rev. Internat. Falsif., 8 (1895), No. 9, p. 157*).—To the solution to be tested add 5 cc. of a solution containing 0 3 gm. of bichromate of potash and 0.25 gm. of anilin per liter and a drop of 5 per cent oxalic acid. A rose-violet coloration results.

Estimation of small quantities of chlorin in fats, R. BENEDIKT and H. ZIKES (*Chem. Ztg., 18 (1894), pp. 640, 641; abs. in Jour Chem. Soc. London, 67–68 (1895), pp. 84, 85*).

Method of detecting chlorin, bromin, and iodin in organic compounds, P. N. RAIKOW (*Chem. Ztg., 19 (1895), No. 39. pp. 902, 903*).

On the determination of potassium sulphate in wines, L. HUGOUNENQ (*Jour. Pharm. et Chim., ser. 6, 1895, No. 1, p. 349; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., No. 11, p. 128*).

Detection of salicylic acid in beer, R. J. L. SCHOEPP (*Nederl. Tjdschr. Pharm., 7, pp. 67–71: abs. in Chem. Centbl., 1895, I, No. 16, p. 856*).—Description and comparison of well-known methods.—W. D. BIGELOW.

On sources of error in alkalimetry, P. DOBRINER (*Ztschr. angew. Chem., 1895, No. 9, pp. 259–262*).

Estimation of iron in the ash of vegetable or animal matter, M. RIPPER (*Chem. Ztg., 18 (1894), pp. 133, 134; abs. in Jour. Chem. Soc. London, 67–68 (1895), p. 86*).

On a new apparatus, the "hema-spectroscope comparator," M. DE THIERRY (*Compt. Rend., 120 (1895), No. 14, pp. 775–777, fig. 1*).

A simple extraction apparatus, R. PRIBRAM (*Ztschr. analyt. Chem., 34 (1895), No. 2, pp. 167–169, fig. 1*).

Some new laboratory apparatus, E. SAUER (*Jour. Amer. Chem. Soc., 17 (1895), No. 6, pp. 494–496, fig. 1*).—A hot-air motor and an illuminating apparatus are described.

New laboratory apparatus, A. VAN DEN BERGHE (*Chem. Ztg., 19 (1895), No. 38, pp. 877, 878, figs. 3*).—Apparatus for (1) constant evolution of gases, (2) estimation of carbonic acid, and (3) modifications of Beckman's apparatus, including boiling tube and condenser and weighing tube.

Apparatus for measuring small quantities of mercury in the determination of nitrogen by the Kjeldahl-Wilfarth method, P. LIECHTI (*Ztschr. analyt. Chem., 34 (1895), No. 2, pp. 169, 170, fig. 1*).

A new burner for sodium light, R. PRIBRAM (*Ztschr. analyt. Chem., 34 (1895), No. 2, pp. 166, 167, figs. 2*).

Improvements in glass cocks, H. WOLPERT (*Ztschr. analyt. Chem., 34 (1895), No. 2, pp. 161–165, figs. 9*).

BOTANY.

A monograph of the genus Delphinium, E. HUTH (*Engler's Bot. Jahrb., 20 (1895), Nos. 3, pp. 322–416; 4, pp. 417–490, pls. 3*).

The effect of spring frosts and the treatment of injured vines, H. MÜLLER-THURGAU (*Jahresber. Vers. Stat. Wädensweil, Weinbau u. Weinhandl., 1894, No. 18 and 19; abs. in Bot. Centbl. Beihefte, 5 (1895), No. 2, p. 134*).

Concerning cuticularization and cutine, VAN WISSELLINGH (*Arch. Neerland. Sci. Exact et Nat., 28 (1894), No. 4 and 5; abs. in Bot. Centbl., 62 (1895), No. 7 and 8, pp. 234–236*).

Concerning the dissolution of secondary cell membranes of seeds during their germination, T. ELFERT (*Bibliotheca Botanica, 1894, No. 20, pp. 26; abs. in Bot. Centbl., 62 (1895), No. 7 and 8, pp. 238, 239*).

Concerning the ascent of sap, E. ASKENASY (*Verhandl. Natur. med. Verein, Heidelberg, 5 (1895), Feb. 12, pp. 23; abs. in Bot. Centbl., 62 (1895), No. 7 and 8, pp. 237, 238*).

A critical investigation of the so-called water pores, A. NESTLER (*Nova Acta Carol. Leop. Akad., 64, No. 3, pp. 38, pls. 2*).

Structure of the hymenium of Marasmius sp., J. DE SEYRES (*Compt. Rend., 120 (1895), No. 14, pp. 763-765*).

Investigations in geotropism, F. CZAPEK (*Jahrb. wiss. Bot., 37, No. 2, p. 339*).

Irritability and movement in plants, D. T. MCDOUGAL (*Pop. Sci. Monthly, 47 (1895), No. 2, pp. 225-234, figs. 6*).

Argon, nitrogen, and plants (*Gard. Chron., 17 (1895), p. 489*).

Is argon contained in vegetable or animal substances? G. W. MACDONALD and A. M. KELLAS (*Proc. Roy. Soc., 57 (1895), No. 345, pp. 490-492*).—The authors investigated peas and the carcasses of mice with negative results.

The availability of free nitrogen as plant food, G. DE CHALMOT (*Agl. Sci., 8 (1894), No. 10 and 11, pp. 471-482*).—A review of recent publications.

Recent publications on tubercle bacteria of legumes and the fixation of free nitrogen through their presence, STUTZER (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 2, pp. 68-74*).—A résumé.

Concerning Heterodera radicicola producing root tubercles on the tomato, F. CAVARA (*Ztschr. Pflanzenkrank., 5 (1895), No. 2, pp. 66-69, table 1*).

Individual variations, G. HENSLOW (*Nat. Sci., 1895, June, pp. 385-390*).—An attempt to classify variations in plants.

The simultaneous origin of similar or identical varieties from different stock, W. W. TRACY (*Amer. Nat., 29 (1895), No. 341, pp. 485, 486*).

Geographic botany—observations on the origin of cultivated plants, A. ENGLER (*Abs. in Ann. Agron., 21 (1895), No. 3, pp. 137-138*).

Influence of humidity of soil on the transformation of terrestrial plants, A. ALOI (*Atti Acad. Giorn. Bot., 7 (1894), ser. 4*).

Native plants poisonous to stock, J. H. MAIDEN (*Agl. Gaz. N. S. W., 6 (1895), No. 2, pp. 57, 58*).—This is an enumeration of plants growing in New South Wales supposed to be poisonous.

Concerning plant breeding, A. KIRSCHE (*Fuhling's landw. Ztg., 44 (1895), No. 7, pp. 215-221*).

Phenology as a connecting link between biology and climate, S. GUNTHER (*Munich: Aschendorf*).

A handbook of systematic botany, E. WARMING (*Trans. by M. C. Potter London: Swan, Sonnenschein & Co., 1895, pp. 620*).

A student's text-book of botany, S. H. VINES (*London: Swan, Sonnenschein & Co., 1895, pp. 821, figs. 483*).

FERMENTATION—BACTERIOLOGY.

On the conditions affecting bacterial life in Thames water, E. FRANKLAND (*Proc. Roy. Soc., 57 (1895), No. 345, pp. 439-449*).—The author found as a rule that the number of bacteria per cubic centimeter increased with the increased hourly flow of water.

Methods of making pure cultures of microörganisms, F. SCHÖNFELD (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 4 and 5, pp. 180-185*).

Concerning the preparation of agar, C. S. HAEGLER (*Centbl. Bakt. und Par. Med., 17 (1895), No. 16, pp. 558, 559*).

A simple method for the isolation of bacteria in agar and blood serum cultures, G. BANTI (*Centbl. Bakt. und Par. Med., 17 (1895), No. 16, pp. 556, 557*).

The action of light upon bacteria, H. M. WARD (*Phil. Trans. Roy. Soc., 1895, p. 961; abs. in Nat. Sci., 1895, June, pp. 371, 372*).

Physiological study of acetic fermentation and artificial vinegar production, F. LAFAR (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 4 and 5, pp. 129–150*).

Investigations on the acetic bacteria, E. C. HANSEN (*Compt. Rend. lab. Carlsberg, 3, No. 3, pp. 182–216; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 1, pp. 31–37*).

The effect of copper sulphate on the fermentation of grape must through Saccharomyces ellipsoides, F. KRÜGER (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 1, pp. 10–16; 2, pp. 59–65*).

On the presence of a diastase in broken vines, G. GOUIRAND (*Compt. Rend., 120 (1895), No. 16, pp. 887, 888*).

Concerning the recognition and distribution of glucose, the enzyme of maltose, M. W. BEYRINCK (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 6, pp. 221–229; 7 and 8, pp. 265–271; 9 and 10, pp. 329–342*).

Aspergillus oryzæ, the fungus of Japanese saki brewing, C. WEHMER (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 4 and 5, pp. 150–160; 6, pp. 209–220, pl. 1*).

On the development of the spores of Saccharomyces membranæformis, S. ludwigia, and S. anomalus, J. C. NIELSEN (*Compt. Rend. Lab. Carlsberg, 3, No. 3, p. 176; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 4 and 5, pp. 187, 188*).

Contribution to the study of variability and transformation in microbiology apropos a new variety of charbon bacillus (Bacillus anthracis claviformis), A. CHAUVEAU and G. PHISALIX (*Compt. Rend., 120 (1895), No. 15, pp. 801–807, fig. 1*).

ZOÖLOGY.

The pocket gophers of the United States, V. BAILEY (*U. S. Dept. Agr., Division of Orinthology and Mammalogy Bul. 5, pp. 46, pl. 1, map 1, figs. 6*).—This bulletin contains popular information on the more common species of pocket gophers of the United States, and is supplementary to the elaborate technical paper in North American Fauna No. 8 (E. S. R., 6, p. 787). The habits of the animals are described at length, and the mechanical action of the teeth is detailed. The injury done by gophers to different crops and trees and the damage caused by their burrows is discussed. Fumigating the burrows with bisulphid of carbon is recommended as the best means of destroying the animals, but other remedies, such as trapping and poisoning with strychnin or phosphorus, are also mentioned. The geographical distribution of the several species is set forth, and separate notes given of the habits of the Georgia gopher (*Geomys tuza*), prairie gopher (*G. bursarius*), plains gopher (*G. lutescens*), Louisiana gopher (*G. breviceps*), sandy gopher (*G. arenarius*), Padre Island gopher (*G. personatus*), Baird's gopher (*Cratogeomys casanops*), and gray gopher (*Thomomys talpoides*).

On the location of the coloration of brown oysters, J. CHATIN (*Compt. Rend., 120 (1895), No. 16, pp. 884–887*).

The fauna of British India, including Ceylon and Burma (Moths) III, G. HAMPSON (*London: Taylor & Francis, 1895; abs. in Nature, 1895, p. 605*).

METEOROLOGY.

Condensation of atmospheric moisture, C. BARUS (*U. S. Dept. Agr., Weather Bureau Bul. 12, pp. 101, pls. 4, figs. 27*).—The proposed scope and the results of the work in this line planned over 2 years ago

and pursued for about 1 year in the meteorological laboratory of the Bureau, are thus outlined by the author:

"Following the instructions of Prof. Mark W. Harrington, it will be my purpose in the course of the present researches to trace the isothermals of water, experimentally, throughout the region of changes of physical state from liquid to vapor. By mapping out the whole of the stable contours I hope to reach definite results relative to the unstable part of their path, believing that this—the field of collapse, as it may be called—is of marked meteorological importance. Incidentally, I shall also obtain data for the law of growth of water globules, from the smallest physically appreciable dimensions to the largest attainable size, and thus supply another series of meteorological results. The subject of research considered from these two points of view may be termed the condensation problem, assuming that the stated condensation takes place in a medium of air.

"Necessarily my work at the outset will consist of an investigation of promising methods, and the present bulletin contains about as much experimental evidence as I am able to adduce by the aid of the supersaturated moist air obtained from steam jets, when the results are interpreted by methods of optical interference. I make a survey of the subject in Chapter I, for changes of state in general. Chapter II follows with an account of the condensation phenomena produced by the jet method, together with their bearing in the condensation problem. Chapter III contains an application of this method to the meteorology of dust (so called). Chapter IV and V, finally, give succinct information as to the distribution of temperature met with in the jet experiments, to be used in the interpretation of Chapter II.

"I had hoped to add to this bulletin certain data on the growth of water globules, to be reached by the method sketched in Chapter II, but the urgency of a change in the location of the laboratory has compelled me to break off my work at an earlier stage of progress."

The display of wind signals on the Great Lakes (*U. S. Dept. Agr., Weather Bureau Circular Apr. 1, 1895, pp. 13, pl. 1*).—Explanations and illustrations of the wind signals to be displayed on the Great Lakes, and lists of Weather Bureau stations and wind signal display stations on the Great Lakes, with the names of the official displaymen in charge, and of the places at which storm warnings will be posted.

Meteorologic and magnetic observations at Genoa, Italy, 1893 (*Regio Università di Genova, Anno LXI. Genova: pp. 39*).—In addition to the ordinary meteorologic and magnetic observations for 1893, normal values are given for temperatures, rainfall, and pressure from observations made during 60 years (1833–1892).

The mean winter temperature is 8.6° C.; the mean spring temperature is 14.3°; the mean summer temperature is 23.5°; the mean fall temperature is 17.1°; the mean annual temperature is 15.9°.

The absolute maximum temperature was 35° C. on August 12, 1861; the absolute minimum was −6.5° C. on January 18, 1891. The normal annual rainfall was 1,298.2 mm. (51.1 in.); the maximum annual fall was 2,752 mm. (108.4 in.) in 1872; the minimum annual fall was 717.4 mm. (28.2 in.) in 1864. The mean number of rainy day was 123; the mean number of clear days was 132.—O. L. FASSIG.

Monthly Review of the New Mexico Weather and Crop Service (*Jan., 1895, pp. 18*).—New Mexico has been added to the list of States and Territories now issuing printed reports. By recent act

of the territorial legislative assembly a weather and crop service was established, thus giving State aid to a service which has existed since 1891 under the direction of the National Weather Service. The act also provides for the printing and free distribution of a "weekly weather crop bulletin during the season from April 1 to October 1, in each year, and a monthly report throughout the entire year, containing climatological and agricultural matter of public interest and educational value." An annual report is also provided for. The director of the service is H. B. Hersey.—O. L. FASSIG.

On the minimum temperatures observed the past winter at the summit of Mount Blanc, J. JANSSENS (*Compt. Rend., 120 (1895), No. 15, pp. 807–809*).

Monthly weather review of the Iowa Weather and Crop Service (*vol. 6, No. 4, pp. 13, dgm. 1*).

WATER—SOILS.

Researches on assimilable nitrogen and its transformations in arable soil, M. PAGNOUL (*Compt. Rend., 120 (1895), No. 15, pp. 812–815*).—Experiments were made in bottomless cases sunk in the soil and inclosing 60 kg. of soils. Different fertilizers and green manures were used and some of the cases were exposed, while others were protected from rain. Ammoniacal, nitrous, and nitric nitrogen were determined in 60 gm. samples of the soil taken at the beginning of the experiment and at intervals afterwards. The cases remained without vegetation during the experiments. For the purpose of studying the effect of vegetation on the loss of nitrogen from the soil 6 pots containing 6 to 7 kg. of the same soil were used. Three were covered with vegetation and the remainder bore no plants. From the 3 pots without vegetation 190 mg. of nitric nitrogen was obtained in the drainage, from the others only 0.15 mg. Three pots were also used to determine the effect of bisulphid of carbon on nitrification.

The conclusions drawn are as follows:

(1) Rainfall, when abundant, may cause considerable loss of nitric nitrogen in rich soils.

(2) Vegetation on the soil may reduce this loss, as shown by Dehérain.

(3) Sulphid of carbon, while it does not destroy the nitric ferment, temporarily retards its action.

(4) The ammoniacal form of nitrogen appears to be a transition state of organic nitrogen in passing to the nitric form, and sulphid of carbon simply temporarily retards transformation at this period.

(5) The nitrous form is also a transitory and unstable state of nitrogen passing from the organic to the nitric form.

Solubility of phosphates in the soil, E. POLLACCI (*Rendic. R. Inst. Lomb., 27, p. 15; abs. in Chem. Ztg., 19 (1895), No. 2, Repert., p. 5*).—An examination of a large number of soils of Lombardy showed that, as a rule, the phosphoric acid was soluble only in strong acids, but

that in a number of cases it was soluble to a marked degree in carbonic acid water, iron phosphate being decomposed by this reagent with special ease. For these reasons carbonic acid water is recommended as a solvent for determining available phosphoric acid in soils and fertilizers. Further investigations showed that the fertilizing constituents carried down in the soil by rain rise to the surface again in time of drought. For this reason it is probable that not only the phosphoric acid of the upper layer but of the lower layers of the soil is utilized by the plant. Analyses of the soil should therefore extend below the tilled layers.

Note on the chemical and bacteriological examination of water, with remarks on the fever epidemic at Worthing in 1893, A DUPRÉ (*Analyst, 20 (1895), April, pp. 73-79*).

The interpretation of the results obtained upon the chemical and bacteriological examination of potable waters, J. C. THRESH (*Analyst, 20 (1895), April, pp. 80-91; and May, pp. 97-111*).

Experimental studies on the filtration of water by sand filters, G. KABRHEL (*Arch. Hyg., 22, No. 4, pp. 323-350*).

Contribution to the study of drinking water, H. SALZMANN (*Ber. pharm. Ges., 1895, No. 5, p. 135; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., No. 11, p. 127*).

Soil investigations, V. VEDRÖDI (*Chem. Ztg., 19 (1895), No. 17, p. 351*).—Ten analyses are reported, which were made to determine the effect of falling leaves on the humus content of the soil. The results were not conclusive.

An observation on soil inoculation, G. JASPERS (*Deut. landw. Presse, 22 (1895), No. 28, p. 266*).—Reference is made to a statement by von Landsberg that the lupine thrives without inoculation on land which has grown broom (*Sarothamus scoparius*). On such land the author observed that lupines flourished even at the bottom of pits on railroad cuts several yards deep. This he assumes as proof that the organism causing root tubercles may sink deep into the soil and retain its vitality for a long time. The superiority of marl over lime for leguminous plants he thinks may be due to the marl containing this organism.

Circulation of water in soils, M. WHITNEY (*Rpt. Kansas Bd. Agr. 1893, pp. 348-360*).

Conserving soil moisture, W. P. TABER (*Amer. Agr. (middle ed.), 1895, June 1, p. 594*).—An abstract of a paper read before the Western New York Horticultural Society, recording successful experiments with thorough tillage and the use of cover crops, green manures, and wood ashes for this purpose.

Note on humus, J. JOFFRE (*Bul. Soc. Chim. Paris, 13-14 (1895), No. 8, pp. 443, 444*).—The results of pot experiments with buckwheat and white mustard grown in soils containing humus and free from humus are briefly reported, which the author believes confirm the conclusions of Bréal regarding the power of plants to assimilate humus (E. S. R., 6, p. 284).

FERTILIZERS.

Contribution to the mineral requirements of plants, W. BENECKE (*Ber. deut. bot. Ges., Generalversammlung, No. 12, p. 105; abs. in Chem. Centbl., 1895, I, No. 15, p. 792; and Chem. Ztg., 19 (1895), No. 20, Repert., No. 6, p. 70*).—Experiments with nutritive solutions in pure cultures of *Aspergillus niger* and *Penicillium glaucum* showed that calcium was

essential to the growth of these plants, and that potassium was also required, although to a less extent. Rubidium and cæsium could not replace potash. The beneficial effect observed in connection with the use of the two former was probably due to the presence of small quantities of potash. Berylium and magnesium retarded the growth of chlorophyll plants, being especially injurious to the roots.

On the manufacture of phosphate of potash, JAY and DUPASQUIER (*Bul. Soc. Chim. Paris, 13-14 (1895), No. 8, pp. 441-443*).—The method proposed consists of thoroughly mixing bisulphate of potash, prepared by heating muriate of potash with two equivalents of sulphuric acid to 150° C., with phosphate of lime and sulphuric acid, in the same manner as in the manufacture of superphosphates. The mass thus obtained is allowed to lie for two or three days and then carefully leached. The phosphate of potash is obtained from the solution by crystallization. A concentrated fertilizer especially adapted for transportation to distant points is thus obtained. For local use the mixture of phosphate of potash and sulphate of lime just as it comes from the mixer is recommended.

Experiments with various phosphates at Borsbeke-lez-Alost, Belgium, P. DE VUYST (*Cultures Spéciales, Borsbeke lez-Alost, 1894, pp. 54-61; L'Engrais, 10 (1895), No. 20, pp. 168-170*).—Experiments in duplicate with beets, corn, oats, clover, and grass on plats of 30 square meters, with (1) equal amounts of phosphoric acid in different forms, and (2) equal values of the different phosphates, are reported. The average results of all experiments are shown in the following table:

Results of experiments with different phosphates.

	Comparative yield		Net return.		Proportion of P_2O_5 applied absorbed by plants.	
	1	2	1	2	1	2
			Francs.	*Francs.*	*Per cent.*	*Per cent.*
Without phosphate	75.3	75.3				
Superphosphate	100.0	100.0	45.3	45.3	5.03	5.03
Slag	93.2	97.7	33.1	40.1	3.30	3.85
Ciply phosphate	81.9	88.5	19.8	18.1	1.98	1.21
Liège phosphate	82.2	[illegible]	8.5	30.7	1.50	1.55

With equal applications of phosphoric acid it is seen that during the first year superhosphate was much superior to slag and mineral phosphate as regards yield, net return, and quantity of phosphoric acid utilized by the crop. When equal values were used superphosphate still proved superior in all these respects, but was closely followed by the slag, while the Liège phosphate also gave very good results. The latter was especially effective on moist meadows, probably on account of its lime.

The results in general indicate that if good results the first year are desired, superphosphate and slag should be used on soils of the character of those employed in these experiments.

Experiments with phosphatic fertilizers on natural meadows, E. MARRE (*Prog. Agr. et Vit.*, *12* (*1895*), *No. 20*, *pp. 524–529*, *dgm. 1*).—Experiments with superphosphate, Thomas slag, and natural phosphate of lime by 11 farmers in different parts of the Department of Aveyron are reported. With superphosphate the increase in yield was appreciable, the net return per hectare being 41.8 francs. With slag the results were also as a rule satisfactory, the net return being 7.95 francs; but the increase with the natural phosphate was very small, resulting in a net return of only 1.56 francs per hectare. The experiments are to be continued through several years more to observe the after effect of the different phosphates before conclusions are drawn as to best form of phosphate for natural grass lands.

The influence of bisulphid of carbon on the denitrifying organisms of manure (*L'Engrais*, *10* (*1895*), *No. 18*, *p. 423*).—The investigations of Wagner at Darmstadt are referred to as showing that the preservative action of bisulphid of carbon on manure and its fertilizing value in the soil are probably due to destruction of the denitrifying organisms by this substance.

About green manuring (*Cult. and Country Gent.*, *1895*, *May 30*, *p. 419*).

Barnyard manure and nitrate of soda, L. GRANDEAU (*Jour. Agr. Prat.*, *59* (*1895*), *No. 22*, *pp. 775–777*).—A review of Wagner's and Kühn's work.

The care of barnyard manure, J. H. VOGEL (*Fühling's landw. Ztg.*, *44* (*1895*), *No. 10*, *pp. 320*, *321*).

Composting manure (*Cult. and Country Gent.*, *1895*, *May 30*, *p. 419*).—Advises the use of sulphate of potash or kainit instead of gypsum.

The cause of the incomplete utilization of the nitrogen of fresh manure, BLANCHARD (*Jour. Agr. Prat.*, *59* (*1895*), *No. 17*, *pp. 612–616*, *figs. 5*).—A review of Wagner's investigations indicating that the addition of fresh manure to the soil causes the decomposition of nitrates present by means of the bacteria which it contains and results in the escape of the nitrogen in the free state.

Field experiments with poudrette (*Mitt. deut. landw. Ges.*, *1895*, *No. 7*, *pp. 73–75*).

Manure, nitrate, and bisulphid of carbon, L. GRANDEAU (*Jour. Agr. Prat.*, *59* (*1895*), *No. 20*, *pp. 707–709*).—A popular article based largely on work of Lawes and Gilbert, P. Wagner, and A. Girard.

Recent progress in the fertilizer industry, VON GRUEBER (*Chem. Ztg.*, *19* (*1895*), *No. 31*, *pp. 706–708*).—The extent of the German trade in raw materials furnishing phosphoric acid, potash, and nitrogen is discussed, and improvements in apparatus and methods for fertilizer manufacture and analysis are noted. Among other things it is stated that the Tennessee phosphates contain a considerable percentage of pyrites which seriously impairs their value for the manufacture of superphosphates.

A study of the agricultural value of the phosphates of alumina of Grand Connétable, A. ANDUARD (*Ann. Agron.*, *21* (*1895*), *No. 4*, *pp. 171–181*).

"Texana manure" and other cheap fertilizers, E. B. VOORHEES (*Rural New Yorker*, *1895*, *June 1*, *p. 376*).

Fraud in fertilizers, A. CADORET (*Prog. Agr. et Vit.*, *12* (*1895*), *No. 14*, *pp. 371*, *372*).

Commercial fertilizers, R. FRESENIUS, E. NEUBAUER and E. LUCK (*Die künstlichen Dünger*. *Wiesbaden: C. W. Kriedel*, *pp. 28*).

FIELD CROPS.

Corn and cotton, A. J. BONDURANT (*Alabama College Sta. Bul. 62*, *pp. 63–72*).—A test of 14 varieties of corn, and fertilizer experiments with corn and cotton. With 500 lbs. per acre of cotton-seed meal

mixed with superphosphate and kainit the yield of corn was greater than with 666⅔ lbs. of stable manure composted with the same minerals but in greater quantity.

With a compost of green cotton seed, superphosphate, and stable manure the yield of cotton was practically the same whether the compost was applied February 1 or April 17; with superphosphate and with floats, both in composts, the yields of cotton were practically identical. Comparing a mixture containing 500 lbs. per acre of cotton-seed meal with a compost containing 750 lbs. each of cotton seed and stable manure (the mixture and the compost containing equal amounts of superphosphate and kainit), the yield of cotton was greater with the cotton-seed meal mixture.

From an experiment with nitrate of soda and cotton-seed meal, all applied to cotton June 16, or half at this date and half July 5, the author concludes that a "given amount [of fertilizer] used interculturally at an earlier stage of crop growth gave better results than the same quantity, one-half applied at the earlier stage and the other half several weeks later."

Forage plants, H. T. FRENCH (*Oregon Sta. Bul. 35, pp. 35–48*).—Red clover was successfully grown on the station farm for 3 years. Fall seeding without grain proved better than spring seeding. If spring seeding becomes necessary it is recommended to sow clover alone rather than with grain. The author recommends the use of 6 lbs. per acre each of orchard grass and tall oat grass with clover seed, both of these grasses having proved valuable in a mixture with clover. With gypsum at the rate of 75 to 100 lbs. per acre the yield of clover was largely increased. It was most efficient when applied prior to March 15. Directions for curing clover hay and for the choice of soil for clover are given. "There seems to be lime enough in either the white land or the dark soil of the Willamette Valley for its development." The author states that clover makes good silage, but not packing so closely as corn, it is more difficult to exclude the air. He recommends cutting clover very green for silage and running it through a feed cutter. However, good silage was made from whole clover, in which case there was considerable loss.

The most serious enemy of clover at the station was the pocket gopher. The clover root borer and clover mite were present, but did no special damage.

Alsike clover succeeded on the white land, and is recommended for mixing with other clovers and grasses.

The hay from mammoth clover (*Trifolium medium*) was too dusty for horses. "For a light sandy soil the mammoth has some advantages [as a pasture plant] over the less vigorous varieties."

White clover (*Trifolium repens*) is recommended for pastures.

Crimson clover sown in September yielded well on the station farm.

Vetch was successfully grown on the red hill land of the coast moun-

tains and was successfully fed to horses and pigs. Satisfactory silage was also made from it, although it was not so well preserved in the silo as corn.

The flat pea (*Lathryus sylvestris*) withstood drought and gave promise of usefulness as a pasture plant for hill land.

Some forage plants, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 48, pp. 40–42*).—Crimson clover was unable to stand either the dry summers or the cold winters at the station. Young seedling plants of the flat pea withstood drought and cold satisfactorily. Hairy or sand vetch (*Vicia villosa*) died on the approach of hot weather. Sacaline was killed to the ground by a mild frost; the plants that renewed their growth succumbed later to the dry weather. The authors doubted that the plant tested was the genuine *Polygonum sacchalinense.*

Renovating a prairie pasture, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 48, pp. 43*).—On a failing prairie pasture the seeds of several tame grasses were sown after cultivating the surface with a disk harrow. The tame grasses were crowded out by the prairie grass, and the authors conclude that the proper way to renovate native pastures is to take off the stock, harrow the surface early in the spring, and leave the pasture to itself.

Experiments with oats, J. F. HICKMAN (*Ohio Sta. Bul. 57, pp. 97–116*).

Synopsis.—These consisted of tests of varieties in 1893 and in 1894; determinations of the percentage of hull and kernels, shrinkage of grain and straw, and percentage of smutted heads; tests of amount of seed; depth of seeding; and a comparison of disking *vs.* plowing as a preparation for oats. The largest average yield for 4 years was made by Improved American, followed by Japan, Early Swedish, and Prince Edward Island. The best average results were afforded by 5, 6, and 7 pecks of seed per acre. When land was prepared with the plow the yield was greater than when preparation consisted of disking alone.

The experiments are largely in continuation of previous work reported in Bulletin, vol. 5, No. 1, of the station (E. S. R., 3, p. 805).

Varieties (pp. 97–108).—With late seeding (May 8 to 9) in the unfavorable season of 1893 varieties of the Welcome type, with spreading panicle, coarse weak straw, and plump short grain, afforded a larger average yield than the varieties of the Seizure type, with the panicle more or less one-sided, and greater than that of the Wide Awake type, having a longer, more pointed, and lighter berry than the Welcome class. With earlier seeding in 1894 the Seizure group afforded the largest yield. In 1894, 100 lbs. of grain was accompanied by 129 lbs. of straw in the Welcome group, 126 in the Seizure group, 105 in the Wide Awake group, and 89 in the mixed group.

Averaging the results for 4 years, Improved American, of the Welcome class, afforded the largest yield of all varieties, 43.1 bu. per acre; Japan gave the largest average yield in the Seizure group, 40.6 bu.;

Kansas Hybrid the largest yield in the Wide Awake group, 39.7 bu.; and Monarch the greatest yield of the mixed group, 37.8 bu. per acre. The average weight of a measured bushel was 32.7 lbs. in the Welcome group, 30.7 lbs. in both the Seizure and Wide Awake classes, and 30 lbs. in the mixed group.

Percentage of hull and kernel in grain (pp. 108–110).—The highest percentage of kernel, 75.4, was found in the Race Horse variety; the lowest, 64.2 per cent, in the Green Mountain variety. The averages for the Welcome, Seizure, and Wide Awake groups were quite similar, 68.3 to 69.8 per cent of kernel. "From the investigations thus far made, it has not been found that oats of heavy weight necessarily have a smaller percentage of hull than those of lighter weight per measured bushel."

Shrinkage of grain and straw (p. 111).—When oats were stored in sacks in a room from September until the following March the shrinkage in weight was less than 1 per cent. Baled oat straw stored for the same period on an ordinary barn floor shrunk 5.7 per cent.

Amount of seed (pp. 111–113).—This test in 1891 occupied 24 plats. With the Welcome variety 7 pecks of seed per acre gave the largest yield; with the Seizure variety, 9 pecks. "The weight of the product per measured bushel is higher, with a single exception, from the 6 and 7 peck rate than from any other." Taking the average for 5 years the yield from 4 pecks of seed per acre was 39.2 bu.; from 5 pecks, 42.6; from 6 pecks, 42.9; from 7 pecks, 41.8; from 8 pecks, 40.7, and from 9 pecks, 38.

Methods of planting (pp. 113, 114).—The average results of 3 years' tests on clay land show that when the land was plowed before planting the yield was 5 bu. more than when it was simply disked. In 2 years out of 3 the yield was greater when the depth of planting was 2 in. than when the depth was 1 or 3 in. In 1894 on clay soil of the station farm rolling the soil either before or after planting was followed by a decreased yield, but in 1891 on a more sandy soil at Columbus rolling "was a decided benefit."

Some points on smut (pp. 114–116).—The percentage of smutted heads was determined with 4 varieties during 4 years, and in one case 34 per cent of the heads was affected. Directions for the hot-water treatment for destroying smut are given.

Experiments with potatoes, E. H. SMITH (*Wilts County Council Rpt. on Expts. with Potatoes and Onions, Warminster and District, 1891, Appendix H, pp. 5–18, fig. 1*).—These experiments, consisting of tests of varieties, fertilizers, distance, depth of preparation of land, and spraying, were conducted in several localities. In a general fertilizer test nitrogen proved the most effective fertilizing ingredient. With two fractional applications of nitrate of soda, one at planting and one during cultivation, the yield was larger than with the same quantity applied all at once. When the distance between seed pieces was 12 by 21 in. the yield was greater than when the distance was 17½ by 31 in.,

Deep preparation of the soil appeared to exert a favorable effect on the potato crop grown in the second year after trenching was practiced as well as in the first year thereafter.

When sprayed, nearly all varieties tested yielded more than when not treated, the average increase in the crop credited to spraying being nearly $30 per acre.

The specific gravity and the calculated percentage of dry matter are tabulated for each variety tested, and the results of feeding experiments with potatoes made by Girard, in France, are quoted.

Tobacco, J. G. LEE (*Louisana Stas. Bul. 33, pp. 1150–1165*).—Brief directions on the culture of tobacco precede the record of experiments at Calhoun with varieties and fertilizers. On a "bright mulatto sandy soil, with red clay subsoil," fertilized with 400 lbs. per acre of a complete fertilizer, 14 varieties, of a bright type, averaged 913 lbs. of cured tobacco per acre. Unfertilized, the same varieties averaged 359 lbs. per acre.

With fertilizers the largest yield was made by Hester, followed by Ragland Improved, and Locks. Without fertilizers White Stem Orinoco, followed by Sweet Orinoco and Yellow Pryor, proved most productive.

On a rather heavy and tenacious red sandy soil 12 varieties of cigar tobacco, when fertilized with 400 lbs. per acre of a complete fertilizer, averaged 1,076 lbs. of cured tobacco per acre. When fertilized, Connecticut Seed Leaf and Little Dutch were most productive, followed by Pumpelly and Landreth. Unfertilized, Connecticut Seed Leaf and Little Dutch again led, followed by Zimmer, Spanish, and East Hartford.

The heavier red sandy land of the locality was found to be suitable for White Burley and for Orinoco tobacco. Variety tests were conducted on alluvial soil in two other localities in the State.

In a comparison of the nitrogen in cotton-seed meal with that in a mixture of nitrate of soda, sulphate of ammonia, dried blood, and fish scrap, the yield was larger with cotton seed meal.

In a fertilizer test a complete fertilizer afforded the largest yield; nitrogen and phosphoric acid increased the crop more than potash.

Six years' experience with silage, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 48, pp. 33–40*).—A description of the college silos, methods of harvesting silage, and amount of silage stored and fed. On the whole the most satisfactory plant for silage was a variety of corn, Mosby Prolific.

"Of the several fodder cutters which have been tried here, none have given better satisfaction than a 1-horse sledge cutter. It is provided with 2 knives, which are hinged to the body of the sled, and can be folded in on the sled when not in use. It has been improved and made easier to pull by providing it with 4 low and broad cast-iron wheels. It is pulled by a single horse, and cuts 2 rows at a time. Two men stand upon the cutter, each facing a row; as the corn is cut they gather it into armfuls, which they drop in heaps on the ground."

The best covering for silage was found to be about 6 or 8 in. of green grass covered with a few loads of earth. Sweet corn and soja beans made satisfactory silage. Kohl rabi and other plants are also used for silage.

In filling the silos in the favorable season of 1889 exact records were kept of the cost of labor.

"The distance hauled would average about 50 rods. Student labor was paid for at the rate of 10 cts. an hour, teams estimated at 10 cts. an hour, and time of hired men was worth 12.5 cts. an hour. At these rates, it cost $60.08 to fill and cover silo No. 2, or at the rate of 62.3 cts. per ton of material put in. Silo No. 1 cost 70.9 cts. per ton, and silo No. 3, 50.8 cts. per ton.

"During the 6 years we have put away 1,046.22 tons, of which 807.91 tons were sound silage when taken out, 109.44 were rotten, and 128.87 tons were lost in the process of curing; or, putting it in percentages, 77.2 per cent of the total amount put in was good feed, 10.5 per cent was rotten, and 12.3 per cent lost. This silage was fed during a total period of 990 days, or an average of 165 days each year, to an average of 51 head of cattle. The average daily feed per head for the entire period is almost exactly 32 lbs.

"While silage has been a most satisfactory feed to cattle, I would in no case recommend that it be fed to breeding bulls. I have repeatedly observed that when bulls have been fed on it they seem to lose virility, and become slow and uncertain breeders, from which condition, however, they may again recover when fed on dry fodder and grain."

Occasionally silage fed to milch cows before milking tainted the milk, but when fed after milking this trouble was avoided.

Coöperative experimental work (*Tennessee Sta. Bul., Vol. VII, No. 3, pp. 157–168*).—Notes on coöperative work undertaken by the station in the culture of beets and potatoes. Tabulated data give analyses of 22 samples of beets grown in different localities in the State in 1894, and of 17 samples of potatoes grown in 3 localities. The beets grown on the station farm afforded the highest percentage of sucrose, 16.2, and the highest purity coefficient, 91.01. The yield on the station farm was at the rate of 17.4 tons per acre; beets were planted very close, and averaged only 7.8 oz. in weight.

Effect of seed exchange upon the culture of wheat, H. L. BOLLEY (*North Dakota Sta. Bul. 17, pp. 85–102*).—Samples of wheat of one variety were obtained from many different parts of the State and planted on the station grounds. Likewise samples of seed grown at the station were sent to different parts of the State. The author's conclusions are as follows:

"(1) Varieties of wheat do not degenerate because of continuous growth upon the same soil.

"(2) Different samples of seed of same variety, which were grown upon different soils under like climatic conditions, will produce a like crop when seeded under sameness of conditions.

"(3) The theory that proper wheat culture demands a frequent change of soil is fallacious.

"(4) It is not demonstrated that any advantage is gained by the use of seed previously grown under different climatic conditions from those under which it is to be used.

"(5) Failure often results from injudicious seed exchange.

"(6) Smut and weeds are often introduced by change of seed.

"(7) Seed exchange, as practiced, precludes any proper methods of crop improvement by careful culture and seed selection.

"(8) Only perfectly formed, plump, hard grain should be seeded, but each farmer should grow his own seed, attempting to bring it to the highest grade of perfection and purity of variety by proper methods of selection and culture without seed exchange."

Tests of varieties of wheat, D. O. NOURSE (*Virginia Sta. Bul. 41, pp. 85–88*).—This is in continuation of previous work reported in Bulletin 28 of the station (E. S. R., 5, p. 495). Notes and tabulated data are given for 16 varieties tested during 4 years and for 5 varieties grown 1 year at the station. The largest average yields of grain were made by Tuscan Island, Valley, Tasmanian Red, and Fultz, in the order named. Of the varieties tested 1 year, Early White Leader gave the largest yield, 27 bu.

Remarks concerning the cultivation of alfalfa (*New York State Sta. Bul. 80, pp. 576–578*).—Brief notes on the selection of soil, the amount of seed, the quality of the seed, and the care of the crop.

Improvements in barley culture through preparation of the seed, M. HOLLRUNG (*Ztschr. landw. Ver. Rheinpreussen, 63 (1895), No. 11, pp. 105, 106*).

Experiments on the variation of barley in different places, VON LIEBENBERG, (*Mitt. Ver. Ford. landw. Versuchsw. Oesterr., 1894, II, No. 9, pp. 69–103*).—No definite conclusions are reached, and repetitions of the experiment are considered necessary by the author.

A perennial bean (*Braunschw. landw. Ztg., 63 (1895), No. 18, p. 81*).—A German plant breeder reports having a bean which is perennial in habit when its roots are protected during winter.

The Roman camomile (*Jour. Agr. Prat., 59 (1895), No. 21, pp. 753, 754, fig. 1*).—The methods of propagating, cultivating, and harvesting this medicinal plant are outlined.

Corn, H. T. FRENCH (*Oregon Sta. Bul. 35, pp. 47–48, pls. 2*).—The varieties Minnesota King and Early Mastodon were found to produce hard, well-matured corn in the Willamette Valley. The variety recommended for silage is Pride of the North.

Varieties of corn for forage, RAMM (*Deut. landw. Presse, 22 (1895), No. 29, pp. 274, 275*).—Figures show the entire ear, cross section of ear, and cross section of grain of dent, flint, soft, sweet, and pop corn.

Flax culture, STREBEL (*Ztschr. landw. Ver. Rheinpreussen, 63 (1895), No. 18, pp. 141–144; Würt. Wochenbl. Landw., 1895, No. 13, pp. 183, 184*).

Plants for forage and green manuring, C. FRUWIRTH (*Fühling's landw. Ztg., 44 (1895), No. 5, pp. 142–148*).—Those discussed at greatest length are hairy vetch, flat pea, serradella, and Japanese buckwheat.

Hemp (*Agl. Jour. Cape Colony, 8 (1895), No. 9, pp. 210, 211*).—A popular article giving methods of cultivating, harvesting, and preparing for market.

Fertilizer experiments on meadows (*Landw. Centbl. Posen, 23 (1895), No. 5, pp. 25, 26*).

The blue lupine for green manuring and for food, STEIGER (*Fühling's landw. Ztg., 44 (1895), No 7, pp. 214, 215*).—The stubble and roots contained 20 per cent dry matter and 0.944 per cent nitrogen, or 35 lbs. of nitrogen per acre; the other part of the plant contained 18.1 per cent dry matter and 0.865 per cent of nitrogen, or 105 lbs. per acre.

Report on fertilizer experiments on permanent pasture in 1894, T. WINTER (*University College of North Wales, pp. 2*).

Field experiments in Carnarvonshire, 1894, T. WINTER, C. B. JONES, and J. OWEN (*University College of North Wales, pp. 15*).—These consisted of fertilizer tests on meadows and experiments with different mixtures of grass and clover seeds.

The growth of oats, hairy vetch, crimson clover, and beans on soil treated with carbon bisulphid, C. OBERLIN (*Jour. Agr. Prat., 59 (1895), No. 13, pp. 459–464*).

Report of field experiments in Anglesey, 1894, T. WINTER and C. B. JONES (*University College of North Wales, pp. 16*).—The experiments consisted of a test of amount of seed with oats, and of fertilizer tests on meadows, Swedish turnips, and mangel-wurzels. Most of these experiments are to be continued for several years. No conclusions are drawn.

Fertilizer experiments with rye, oats, and meadows, VON LIEBENBERG (*Mitt. Ver. Förd. landw. Versuchsw. Oesterr., 1894, II, No. 9, pp. 125–133*).

Field experiments on oats, K. FINK (*Fühling's landw. Ztg., 44 (1895), No. 8, pp. 241–249*).—Different forms of lime and different phosphates were compared on several farms in western Prussia in 1894.

The potato in poor soils, P. VIALA (*Prog. Agr. et Vit., 12 (1895), No. 21, pp. 560–563*).

Variety tests of potatoes, N. WESTERMEIER (*Deut. landw. Presse, 22 (1895), Nos. 30, pp. 282, 283; 31, p. 295; 32, pp. 305, 306; 34, pp. 323, 324*).

A study of 9 varieties of potatoes, E. VON PROSKOWETZ, Jr. (*Mitt. Ver. Förd. landw. Versuchsw. Oesterr., 1894, II, No. 9, pp. 104–124*).

Experiments with varieties of potatoes, J. SAMEK (*Tirol. landw. Blätter, 14 (1895), No. 8, p. 74*).

Growing rape seed in America, T. SHAW (*Breeders' Gaz., 27 (1895), May 8, p. 291*).

German and Russian rye, I, M. FISCHER (*Fuhling's landw. Ztg., 44 (1895), No. 9, pp. 265–268*).—A statement of the differences in the external quality of the grain from the two countries.

Serradella as a catch crop after rye, L. DANGER (*Deut. landw. Presse, 22 (1895), No. 34, p. 321*).

Sorghum during the last year, P. COLLIER (*Cult. and Country Gent., 1895, Mar. 28, p. 244*).—This article is chiefly concerned with the results of work done at Medicine Lodge, Kansas. The conclusions are that (1) the polariscope test is reliable, (2) as a sugar plant sorghum ranks high, and (3) a satisfactory proportion of sugar is extracted by the diffusion process.

The sugar beet, J. H. SHEPARD (*South Dakota Sta. Rpt. 1893, pp. 47–76*).—A reprint of Bulletin 34 of the station (E. S. R., 5, p. 184).

Tea, G. A. STANTON (*Jour. Soc. Arts, 1895, Jan. 23, pp. 19, figs. 3*).—This article deals with the statistics of the production and consumption of tea.

Analysis of tobacco and its products, V. VEDRÖDI (*Rev. Internat. Falsif., 8 (1895), No. 9, p. 152*).—Reports trials of the methods of Kissling and Kosutany for nicotin. The first is claimed to give too high results, the second too low.

The effect of topping and suckering tobacco plants on the quality of the leaves, J. BEHRENS (*Landw. Vers. Stat., 46 (1895), Nos. 5 and 6, pp. 441–467*).

Silage at the Hawksbury (Australia) Agricultural College (*Agl. Jour. Cape Colony, 8 (1895), No. 7, pp. 167–169*).—Stacks under pressure and rude pits preserved silage satisfactorily under the climatic conditions of that part of Australia.

Deep vs. shallow culture of corn, E. C. HERRICK (*Amer. Agr. (middle ed.), 1895, May 25, p. 569*).—The record of a test in which shallow cultivation afforded a larger yield than deep.

Some problems in tillage, T. SHAW (*Breeders' Gaz., 1895, May 22, pp. 322, 323*).—This article deals with the proper preparation of the soil for flax.

Stephens's catechism of practical agriculture, J. McDONALD (*Edinburgh and London: W. Blackwood & Sons, 1895, pp. 85*).

HORTICULTURE.

Some profitable vegetables for North Dakota, C. B. WALDRON (*North Dakota Sta. Bul. 18, pp. 109-121*).—This bulletin is designed to interest farmers in the cultivation of vegetables in North Dakota where market gardening is to a great extent neglected. Directions are given for the preparation of the soil for the growing of vegetables in general, a deep, mellow, well-drained soil being advised, well manured and tilled, the cultivation being sufficiently frequent to conserve the moisture.

Special detailed directions are given for the culture of cabbage, celery, and onions. It is recommended that cabbage plants be started in February or March under glass, and directions for constructing a hotbed are given. It is advised that the young plants be set out as early in spring as possible, 2 ft. apart in 3 ft. rows, and constantly cultivated to insure rapid growth. Surrounding each plant on setting it in the field with a cuff-like band of stiff paper plunged into the the earth for an inch is stated to prevent damage by cutworms. Hot water, and pyrethrum mixed with flour, are recommended for the aphis and cabbage worm. The culture of cauliflowers is mentioned as being practically the same as that of cabbages, with the addition of irrigation in dry, hot weather.

It is believed that celery can be grown in the State of sufficient quality to compete successfully with that imported from the East. Deep and thorough cultivation is urged, the plants being started in hotbeds in March and set out 8 in. apart in 4 ft. rows the latter part of May. Finely pulverized and well-rotted manure is advised. For blanching, earth banking is preferred to covering with boards, the earth to be thrown up by means of a shovel plow supplemented by a wide hand hoe. The varieties White Plume and Golden Self Blanching are recommended, and wherever practicable irrigation should be employed. The harvested crop is to be stored until wanted in a frost-proof cellar or pit that is not too dry.

In growing onions the new method of culture is preferred, the plants being started in March in shallow boxes and transplanted to the field 4 in. apart in 1 ft. rows as soon as danger from frost is over. Barnyard manure and ashes are recommended for fertilizing, the weeds to be kept down while the crop is growing by means of wheel hoes and hand weeders. The variety Prizetaker is recommended, which in two experiments at the station yielded at the rate of 969 and 1,071 bu. per acre.

The writer strongly urges the farmers of his State to undertake the culture of vegetables, and believes the venture will be profitable if proceeded in with caution.

Variety tests with blackberries, dewberries, and raspberries (*New York State Sta. Bul. 81, pp. 581-591*).—This consists of notes on

the varieties of these fruits grown on the station plats in 1894, only those that are new and have never before fruited at the station being described. Comparative descriptive notes are given for 8 varieties of blackberries, 3 of dewberries, 3 of black raspberries, and the Japanese wineberry.

The yield of 21 varieties of blackberries is tabulated, Evergreen leading, with a yield of 381 oz. of fruit from 5 hills that were allowed to grow together. It is followed by Taylor, Early Mammoth, and Carlo, with yields of 197 oz., 149 oz., and 126 oz., respectively. The fruit of Evergreen is considered of inferior quality.

Of the dewberries, Lucretia was the most productive, but the flavor of the fruit of all the varieties is considered poor. It is urged that both blackberries and dewberries at this latitude must be protected during the winter by laying them on the ground and covering them with a few shovelfuls of earth.

The Japanese wineberry is regarded as not very productive, and as producing fruit inferior in quality to raspberries, although attractive in appearance. The plants were thrifty, but only moderately hardy.

In a table giving data on the yield of 20 varieties of red raspberries Harris led with a yield of 290 oz. from 25 ft. of matted row, followed by Cuthbert, Superb, and Pride of Kent, which gave 193 oz., 174 oz., and 165 oz., respectively. The fruit of Harris is regarded as excellent in both size and quality. Of 6 varieties of purple raspberries growing at the station only 1, Addison, bore fruit, yielding 106 oz. from 5 hills in matted row. The fruit had the flavor of the wild red raspberry. Seven varieties of yellow raspberries are in the collection, of which Caroline led in productiveness. The yellow varieties are considered desirable for home use, though not suitable for marketing. A list is given of 27 varieties of raspberries set out in the spring of 1894.

Fruits, G. COOTE (*Oregon Sta. Bul. 31, pp. 19–29, pls. 2*).—This bulletin comprises notes on various varieties of orchard and small fruits grown at the station, with some general remarks on pollination and fertilization of flowers by bees and otherwise. Tabulated comparative notes are given of the date of blooming and pollen production for 21 varieties of cherries, 28 of plums, 11 of peaches, 14 of pears, and 22 of apples, the relative abundance of pollen being also designated.

Experiments were made with peach trees in a forcing house to determine their power of self fertilization. Fertilization was done by hand, a brush being used, by spraying with water when the trees were in full bloom, and by placing a hive of bees in the house. All the fruit was matured on the tree to which the bees were allowed access, while more or less dropped at the stoning period in the case of the trees fertilized by artificial means. A tree protected from the bees and not otherwise fertilized set no fruit whatever.

Comparative descriptive notes are given on 9 varieties of apples, 5 of cherries, 5 of plums, 15 of grapes, 9 of blackberries, and 13 of raspberries.

The cherry or pear slug (*Selandria cerasi*) was damaging to those trees. Dusting with air-slacked lime was successful as a remedy, while earth dust applied in a similar manner produced no effect.

Garden tillage and implements, S. B. GREEN (*Minnesota Sta. Bul. 38, pp. 183–201, figs. 17*).—It is stated that the cultivation of the soil accomplishes the exclusion of weeds, prepares the surface soil for resisting drought, and renders soluble the insoluble plant foods in the soil by chemical action and fermentation brought about by the air admitted. It is urged that early cultivation be employed for the purpose of preventing the growth of weeds, and that no weeds whatever be permitted to mature seeds. It is advised that barnyard manure intended for the garden be thoroughly rotted before its application to insure the killing of seeds it may contain. It is recommended that gardens be plowed in the fall if the land is wet, several furrows being turned back to back, thus leaving ridges for draining during the winter. When the land is plowed again in the spring these dead furrows are to be obliterated. It is stated that summer cultivation should never be more than 3 in. deep, tillage to the depth of 2 in. usually sufficing, and that during the growth of a crop the surface of the ground should be stirred after each rain or artificial watering to prevent the formation of a crust. The cultivation is stated not only to conserve moisture by providing a mulch of dry earth on the surface, but also to facilitate chemical action and fermentation in the soil by the admission of more air, thus setting free more plant food.

A good horse cultivator is believed to be the most important horticultural tool, although work by means of hand implements will also be necessary to supplement the other. Twenty-one different styles of drills, hoes, cultivators, and harrows, single or in combination, are described, and a number of them figured. For ordinary garden work preference is expressed for such combined implements as permit the attachment of various cultural tools to a universal frame.

Notes on vegetables, G. COOTE (*Oregon Sta. Bul. 34, pp. 29–32*).—This bulletin comprises comparative descriptive notes on 5 varieties of peas, 2 of radishes, 1 of corn, 7 of lettuce, 3 of spinach, 10 of beans, 2 of cauliflowers, and 2 of pumpkins growing at the station. A list of the donations of seed received at the station from various sources is appended.

Experiments in electro-culture in Belgium, P. DE VUYST (*Cultures Spéciales, Borsbeke-lez-Alost, 1894, pp. 63, 64, dgm. 1*).—A brief note on an experiment in which electricity collected from the air was distributed through the soil. Further experiments are to be made before conclusions are drawn.

Commercial lettuce forcing, B. T. GALLOWAY (*Amer. Gard., 16 (1895), No. 36, pp. 135, 136*).—A discussion of soil as a factor in the growth of the crop.

How to grow and market tomatoes, A. W. LIVINGSTON (*Up-to-Date Dairying, 4 (1895), No. 2, pp. 185–187*).—Practical directions.

The treatment of the soil in lime plantations, F. WATTS (*Agl. Jour. Leeward Islands, 1895, No. 3, pp. 69–73*).—An analysis of lime fruit is given and the draft of the crop on the soil discussed.

Pineapple culture, H. W. WARD (*Gard. Chron., ser. 3, 17 (1895), pp. 398, 399*).

A blackberry-raspberry cross, C. H. SHINN (*Irrigation Age, 8 (1895), No. 2, p. 61*).—Notes on the Loganberry.

The pruning of frozen vines, J. PERRAUD (*Prog. Agr. et Vit., 12 (1895), No. 14, pp. 372–374, fig. 1*).

Experiments with chemical fertilizers on the vine, B. CHAUZIT (*Rev. Vit., 3 (1895), No. 69, pp. 353–357*).

The manuring of the vine (*L'Engrais, 10 (1895), Nos. 19, pp. 445–447; 20, pp. 470, 471*).

Researches on the requirements of the vine, A. MÜNTZ (*Compt. Rend., 120 (1895), No. 9, pp. 514–516*).

The production of wine and the utilization of the fertilizing principles of vines, A. MÜNTZ (*Compt. Rend., 120 (1895), No. 11, pp. 635–638; Prog. Agr. et Vit., 12 (1895), No. 14, pp. 364–366*).

Manuring of the vine and the quality of the wine, A. MÜNTZ (*Compt. Rend., 120 (1895), No. 18, pp. 1010–1012; Prog. Agr. et Vit., 12 (1895), No. 21, pp. 547–549*).

Modern canning process (*Chicago Record; abs. in Up-to-Date Dairying, 4 (1895), No. 2, pp. 163–168, figs. 5*).—An account of how tomatoes and corn are handled in large canneries.

FORESTRY.

A new post oak and hybrid oaks, W. W. ASHE (*Jour. Elisha Mitchell Sci. Soc., 11 (1895), No. 2, pp. 87–95*).

Forests and the scarcity of forage, L. GRANDEAU (*Ann. Sci. Agron., 6 (1893), II, No. 2, pp. 205–279*).—Suggestions regarding the utilization of leaves, twigs, etc., of forest trees as forage.

Forestry report, J. C. WHITTEN (*South Dakota Sta. Rpt. 1893, pp. 3–15*).—A reprint of Bulletin 32 of the station (E. S. R., 4, p. 829).

SEEDS—WEEDS.

The influence of nitrates on germinating seeds, G. DE CHALMOT (*Agl. Sci., 12 (1894), No. 10 and 11, pp. 463, 464*).—The author reports that the presence of nitrates in the nutrient solutions affects the germination of corn. Those seeds to which nitrates had been given began to develop on about the fifth day, being more robust than those to which no nitrates were given. In the presence of nitrates the reserve substances of the seed are more readily dissolved, as shown by experiments made with water cultures, and also with plants grown on powdered pumice stone. It was found that if too concentrated solutions were used germination was retarded rather than accelerated. The author states that germinating seeds take up nitrates and convert them into albuminous matter at a very early period in their development. Analyses of 11-day-old corn plants showed 15.92 per cent albuminous matter when nitrates had been added and 11.69 per cent when it had been withheld.

Distribution of weed seeds by winter winds, H. L. BOLLEY (*North Dakota Sta. Bul. 17, pp. 102–105*).—The author has considered the subject of dispersion of weed seeds in two ways, (1) by melting drifting snow and finding the number of weed seeds contained in it,

and (2) by actual study of the traveling of different seeds over the snow during constant winds. The contents of two snowdrifts were examined. The first was on an ice pond fully 10 yards from any standing weeds and was about 3 in. deep. Two square feet of this snowdrift contained 19 weed seeds, as follows: *Setaria glauca* 2, *Thlaspi arvense* 5, *Artemisia* sp. 2, and *Panicum crus-galli* 10. The second drift was upon plowed land 10 rods away from standing weeds. Two square feet of this drift contained 32 weed seeds, as follows: *Amarantus* sp. 2, *Rumex maritimus* 2, *Polygonum erectum* 2, *P. convolvulus* 2, *Ambrosia trifida* 1, *A. artemisiæfolia* 3, *Brassica sinapistrum* 1, *Hierochloe borealis* 1, and *Setaria* sp. 18.

In testing the seed carrying power of winds mixed seed was poured upon crusted snow and the rate and distance of traveling under the influence of wind was noted. In the first experiment, with the wind blowing at the rate of 20 miles per hour, a peck of mixed seed was poured out upon the crust and at a distance of 30 rods at right angles to the course of the drifting seeds a trench was dug in the snow. At the end of 10 minutes it was found to contain many of the seeds, and the lightest of the seeds had all been disseminated from the pile, and were for the most part carried across the shallow ditch. In the second experiment, with the wind blowing at the rate of 15 miles per hour, one half bushel each of oats and broom corn millet seeds were poured upon snow crust. In 40 seconds the seeds of both kinds in considerable quantity had passed over 20 rods. At the 20 rods distance it was found that the seeds had spread over a total width of 8 rods at right angles to the direction of the wind. Within 15 minutes numerous seeds of millet and some of the heavy oats were found at a distance of 80 rods. In the third experiment it was found that, with a 25 mile an hour wind, wheat grains drifted a distance of 30 rods in 1 minute. From these experiments it is shown that on the great plains where the winds keep a constant direction for several days they result in widely scattering seeds of all kinds.

The Russian thistle in Ohio, A. D. SELBY (*Ohio Sta. Bul. 55, pp. 53–69, pls. 3*).—Notes are given on the appearance of the Russian thistle (*Salsola kali tragus*) in the State, together with illustrated descriptions of the weed. The descriptions are largely compiled from Bulletin 15 of the Division of Botany of this Department (E. S. R., 6, p. 144). A classification of weeds is given in which they are divided into annuals, biennials, and perennials. Mention is made of weed seeds frequently met with in millet and clover seed and the importance of using only clean seed is shown. The acts of the legislature relative to weed destruction are given, together with quotations from the Wisconsin and South Dakota weed laws. The text of the Ohio law relating to black knot and peach yellows is also given.

Effect of formic aldehyde fumes on the germinative ability of seeds, A. GOTTSTEIN (*Hyg. Rundschau, 4, pp. 776, 777; abs. in Chem. Centbl., 1895, I, No. 1, p. 62*).

The vitality of seeds, W. B. HEMSLEY (*Nature, 52 (1895), May 2, pp. 5–7*).

The vitality of seeds (*Gard. Chron., ser. 3, 17 (1895), pp. 614, 615*).

Some plants injurious to stock, T. A. WILLIAMS (*South Dakota Sta. Rpt. 1893, pp. 21-44, pls. 5*).—A reprint of Bulletin 33 of the station (E. S. R., 4, p. 924).

Thorn apple, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 21, pp. 2*).—Illustrated notes on *Datura stramonium*.

Bathurst bur, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 2, pp. 2*).—Illustrated notes on *Xanthium spinosum*.

Giant burdock, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 13, pp. 2*).—Illustrated notes on *Arctium lappa*.

Thistles, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 18, pp. 10*).—Illustrated notes on *Centaurea calcitrapa, C. solstitialis, C. melitensia, Silybum marianum, Carduus pycnocephalus,* and *Cnicus arvensis*.

Weeds of New Zealand, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1894, pp. 58-75, figs. 10*).—Illustrated notes are given on some of the worst weeds of the country, together with directions for their eradication.

DISEASES OF PLANTS.

Ripe rot or bitter rot of apples, W. B. ALWOOD (*Virginia Sta. Bul. 40, pp. 59-82, pls. 2*).—The author has given a report of a critical study of the ripe rot of apples due to *Glœosporium fructigenum*. The history, nomenclature, occurrence and distribution, gross and microscopic appearance of the parasite, character of spores and mycelium, discussion of the method by which the fungus survives the winter, economic notes, and a bibliography of titles with brief notes as to their character are given.

Raspberry anthracnose (*New York State Sta. Bul. 81, pp. 592-594*).—During the past season experiments were begun in treating the canes for raspberry anthracnose, the object being to ascertain whether the disease could be successfully combated, and secondarily to test different solutions for the first treatment so that comparison might be made as to their efficiency in treating the disease.

For the first application, made before the leaf buds had opened, solutions of copper sulphate, iron sulphate, and a 10 per cent solution of sulphuric acid in water, and a 10 per cent solution of sulphuric acid added to a saturated solution of iron sulphate were used. After the application of these fungicides, April 18, the subsequent treatments were made May 1, 16, 30, June 21, and August 9, all plants being sprayed with Bordeaux mixture. After the last spraying all the old canes were removed and burned. On November 22 the plants of both sprayed and unsprayed rows had made vigorous growth, the canes of the sprayed rows being nearly free from disease, while the others were badly affected.

The experiment is to be continued during the present season along the same lines.

Report of the Royal Botanic Gardens, J. H. HART (*Trinidad: 1894, pp. 15*).—In addition to the usual statements and acknowledgments brief mention is made of cane diseases due to *Trichosphæria sacchari*

and a leaf disease of coffee seedlings due to *Cercospora coffeeicola.* When the coffee plant gets beyond the seedling stage it seems to be safe from attacks of this fungus.

Concerning Phoma betæ, B. FRANK (*Ztschr. Zuckerind., 1895, No. 45, p. 271; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., p. 129*).

Concerning the varying susceptibility to rust of different grains, J. ERICKSSON (*Ztschr. Pflanzenkrank., 5 (1895), No. 2, pp. 80–85*).

Concerning the predisposition of certain species of grain to rust, E. HENNING (*Landt. Akad. Handl. Tidskr., 1894; abs. in Bot. Centbl. Beihefte, 5 (1895), No. 2, pp. 136–144*).

Note on sugar-cane diseases, C. A. BARBER (*Agl. Jour. Leeward Islands, 1895, No. 3, pp. 53–57*).

A disease of peas, F. KRÜGER (*Deut. landw. Presse, 22 (1895), No. 33, pp. 311, 312*).

A banana disease (*Jour. Trinidad Field Nat. Club, 2 (1895), No. 6, p. 146*).—Brief note on supposedly new disease, checked by the application of salt.

The grape disease of Portugal in 1894 (*Abs. in Ztschr. Pflanzenkrank., 5 (1895), No. 2, pp. 95, 96*).

The treatment of mildew and black rot in 1895, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 13, pp. 325–330*).

The blights of Myrtaceæ, P. VUILLEMIN (*Ann. Sci. Agron.. 10 (1893), II, No. 3, pp. 395–431, pls. 3*).

Fungus diseases, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1894, pp. 53–58, fig. 1*).—Brief notes are given on *Helminthosporium ravenelli, Puccinia graminis, Isaria fusiformis, Claviceps purpurea, Plasmodiophora brassicæ, Entomosporium maculatum, Fusicladium dendriticum, Taphrina deformans,* and *Sphærella fragariæ.*

New species of fungi, C. H. PECK (*Torrey Bul., 22 (1895), No. 5, pp. 198–211*).—A list of 37 new species, mostly from California and Newfoundland, is given.

On a Penicillium growing in concentrated solutions of copper sulphate, L. TRABUT (*Bul. Soc. Bot. France, 62 (1895), pp. 33, 34*).

Common fungus diseases, T. A. WILLIAMS (*South Dakota Sta. Rpt. 1893, pp. 79–83*).—Reprinted from Bulletin 35 of the station (E. S. R., 5, p. 194).

Morphology, biology, and systematic arrangement of the mold fungi, B. FISCHER and C. BREBECK (*Jena: G. Fischer, 1894, pp. 52, tables 2; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 6, pp. 245–248*).

Report on plant diseases in Germany in 1894 (Cont.) (*Ztschr. Pflanzenkrank., 5 (1895), No. 2, pp. 97–105*).—Reports on potato, lucern, esparcet, flax, and kohl-rabi diseases.

Treatment of wheat smut and potato scab, H. L. BOLLEY (*North Dakota Sta. Bul. 19, pp. 125–134, figs. 2*).—This bulletin contains a summary of the more essential facts and methods of treatment for each of these diseases, which have already been published in Bulletins 1, 4, and 9 of the station (E. S. R., 2, p. 740; 3, p. 619, and 4, p. 926).

Prevention of beet sickness by means of potash salts, M. HOLLRUNG (*Ztschr. Zuckerind., 1895, No. 45, p. 294; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., p. 129*).

Treatment of chlorosis by sulphuric acid, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 21, pp. 541, 542*).

Burgundy mixture, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 21, p. 544*).—The author says this fungicide has all the good qualities of eau celeste without any of its disadvantages. The formula for 1 hectoliter is copper sulphate 1.5 kg., sodium carbonate 0.75 kg., and ammonia 1 liter.

The treatment of oïdium by sulphurous gas, E. GEBAUDAN (*Prog. Agr. et Vit., 12 (1895), No. 18, pp. 468, 469*).

Concerning animals injurious to sugar beets, A. STIFT (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 11, pp. 398–405*).—A résumé of literature relating to nematodes of various genera.

ENTOMOLOGY.

Cutworms, borers, and bisulphid of carbon, J. B. SMITH (*New Jersey Sta. Bul. 109, pp. 39, figs. 13*).

Synopsis.—This bulletin consists of illustrated descriptive notes on the life history, habits, ravages, and treatment of cutworms, the sinuate pear borer, and the potato stalk borer, and the result of experiments with bisulphid of carbon as an insecticide. Applying kainit to the ground and the use of poisoned trap food is advised for the cutworms, and for the other two insects destroying infested trees and plants is advised. Bisulphid of carbon is recommended as efficient for destroying melon and cabbage maggots, in the latter case being injected into the soil beneath the plants.

Cutworms (pp. 2–13).—General remarks are made on the habits and life history of cutworms as a class, and the larval forms of the dark-sided cutworm (*Carneades messoria*), *Prodenia lineatella*, granulated cutworm (*Feltia annexa*), striped cutworm (*Mamestra legitima*), and corn worm (*Heliothis armigera*) are figured. The adults of the following owlet moths, whose larvæ are cutworms, are illustrated from photographs: *Agrotis ypsilon*, *Peridroma saucia*, *Noctua bicarnea*, *N. c-nigrum*, *N. clandestina*, *Feltia subgothica*, *F. malefida*, *Carneades tessellata*, *C. messoria*, *Mamestra chenopodii*, *Hadena arctica*, and *H. devastatrix*.

It is stated that clover or sod land is most frequently infested by cutworms, which are less frequently found on late cultivated land. The worms are especially abundant in crimson clover. Among the remedies suggested clean culture is placed first, prominently associated with early fall plowing. Applying a top dressing of kainit and nitrate of soda in the early spring if corn is to be planted is advised, the seeding to be delayed until a rain has carried the fertilizers into the soil. Distributing clover or bran that has been moistened with Paris green about the fields is also recommended.

The sinuate pear borer (pp. 13–24).—Notes on the life history and damage caused by *Agrilus sinuatus*, a European species which was probably introduced from France in imported pear stocks some time during the past 10 years. The insect was discovered boring irregular zig-zag channels under the bark of pear trees at Irvington, New Jersey, and vicinity, attacking Bartletts preferably, although no varieties escaped. The life history and habits of the beetle were worked out as completely as possible. The adult was found to make its appearance the last of May or the first of June and lay its eggs about the middle of June in crevices in the bark of the trunk or branches of pear trees. The beetle is about one-third inch long, of a slender, cylindrical form, shining bronze-brown, with granulated and punctured surface. The eggs hatch in July, when the slender white larvæ make delicate burrows in the sapwood, tending downward. As the larvæ grow the burrows become broader, at first sinuate and later zig-zag, and when the galleries of two larvæ meet the branch or tree is frequently girdled, the portion of the

tree above the girdle dying in consequence. In the fall the larva, which is now about 1 in. in length, forms a small cell in the wood about one-fourth inch beneath the bark. The insect hibernates in the larva state, pupating in April, to emerge in about 6 weeks.

The damage produced by this insect is of a very serious nature, sickly and dying trees being frequent throughout the infested region. As remedies are recommended cutting out and burning all infested young trees and employing the German method of applying a paste of clay and cow dung to the bark from May to the end of July, thus preventing the emergence of such beetles as might be in the trees thus treated and the laying of eggs on the coated portions by beetles emerging from other trees. Stimulation by liberal fertilizing is also recommended.

An abridged history of the species in Europe is given, and the methods of treatment there employed are mentioned.

The potato stalk borer (pp. 23-25).—This insect (*Trichobaris trinotata*) developed to a damaging extent in potato fields in the neighborhood of Trenton Junction and some other portions of the State, it being the first State record for the pest. The potato vines were infested with hardly a single exception, there frequently being from 3 to 6 specimens of larvæ to each vine in both the main stem and branches. The insect was assisted in its work of destruction by a severe drought and the presence of a fungus disease. The adult insects were found in the potato vines throughout the entire season, specimens being taken late in the fall. The small white larvæ were first noticed about the middle of July, and the majority of vines attacked rapidly turned yellow and died, although some of the more vigorous plants resisted the pests unless they were present in considerable numbers.

Raking up and burning the potato vines after gathering the crop is advised as treatment, by this means destroying the entire brood of insects, which, as above stated, hibernates in the vines. In addition the Jimson weed and horse nettle, which are also food plants of the insect, should be destroyed, and vigorous growth of the potatoes induced by appropriate soluble fertilizers.

Bisulphid of carbon as an insecticide (pp. 32-39).—This gives results of experiments made with this chemical against the melon louse, in main part presented in a paper read before the Brooklyn meeting of the Association of Economic Entomologists, and reported in Insect Life, Vol. VII, No. 2, p. 110 (E. S. R., 6, p. 650). In addition are quoted experiments with injecting bisulphid of carbon into the ground at the base of cabbage plants to destroy the cabbage root maggot, as given in Bulletin 78 of the New York Cornell Station (E. S. R., 6, p. 911). The value of carbon bisulphid as an insecticide in many instances is strongly urged.

Insects injurious to fruits and vegetables and remedies for destroying them, J. T. STINSON (*Arkansas Sta. Bul. 33, pp. 55-97, figs. 18*).—This bulletin is a popular condensation of information on some of the common insects injurious to fruits and vegetables in the State, with

remarks on various insecticides and formulas for their preparation. Some brief remarks are made on the different stages of insect development and the life cycle in general. Descriptive, life history, and remedial notes are given for the codling moth, apple-tree tent caterpillar, leaf crumpler, oyster-shell bark louse, apple root louse, round-headed apple tree borer, flat-headed borer, peach borer, plum curculio, strawberry leaf roller, strawberry crown borer, smeared dagger moth, tarnished plant bug, imported cabbage plusia, harlequin cabbage bug, cutworms, and Colorado potato beetle. The assistance rendered horticulturists by beneficial predaceous and parasitic insects is briefly touched upon, the ladybirds being especially mentioned. The action of insecticides on biting and sucking insects is discussed, and the application of insecticides in connection with fungicides is recommended for some cases. Applying insecticides in the form of a spray is advised, although for some insects the material may be applied dry. The value and action of Paris green, London purple, arsenate of lead, white hellebore, kerosene emulsion, carbolic acid wash, tobacco decoction, and bisulphid of carbon are stated, and detailed directions given for their use. A list of the firms supplying spraying apparatus is given, and directions appended for sending insects to the station for identification.

The San José scale, C. V. RILEY (*Maryland Sta. Bul. 32, pp. 87–111, figs. 6*).—This bulletin consists of a résumé of the information extant on *Aspidiotus perniciosus*, with an account of its introduction into the East and distribution from nurseries on imported stock. The correspondence with the proprietor of one of the infested nurseries is given, and the belief expressed that owing to the energetic measures employed to stamp out the scale, stock from that nursery is perhaps safer than from others which have not been so thoroughly gone over and treated. The past history of the species is outlined and its history in the Atlantic States given in more detail. The description, life history, parasites, and various remedies against the pest are given at length. At the time of writing the bulletin the scale had been discovered in 5 different localities in Maryland, and its entire extermination is believed to be impracticable, although it is thought its spread and damage can be very much limited. Experiments made by the Department of Agriculture with various insecticides are quoted, and it is believed by the writer that winter spraying with a solution of whale oil soap, 2 lbs. to a gallon of water, will be effective, perhaps supplemented by treatment with hydrocyanic acid gas.

The San José scale, F. M. WEBSTER (*Ohio Sta. Bul. 56, pp. 81–96, pl. 1, figs. 5*).—This is an emergency bulletin issued to give the farmers of the State information in regard to the San José scale, which, in December, 1894, was discovered in Clermont County, where two orchards, one of about 600 trees, were badly infested with the pest. The bulletin is in main part a reprint of New Jersey Stations Bulletin 106 (E. S. R., 6, p. 832), comprising detailed information on the appearance,

life history, injury, and treatment of the scale. The earnest attention of Ohio fruit growers is called to the pest, and energetic measures to stamp it out in the State are urged.

Insects injurious to stored grain, J. M. STEDMAN (*Alabama College Sta. Bul. 61, pp. 35–60, figs. 15*).—This is a compiled bulletin on the subject, with introductory remarks on the life history of insects in general, and the action of various insecticides on biting, boring, and sucking insects. Paris green, London purple, hellebore, white arsenic, pyrethrum, kerosene emulsion, carbolic acid emulsion, tobacco decoction, and bisulphid of carbon are discussed as regards their action, and directions given for their use. Various forms of apparatus for applying insecticides are discussed and figured, and several patent articles are recommended as preferable. Illustrated descriptive and life history notes are given for the following grain insects: Pea weevil (*Bruchus pisi*), bean weevil (*B. obtectus*), four-spotted bean weevil (*B. 4-maculata*), grain or corn weevil (*Calandra granaria*), black or rice weevil (*C. oryzæ*), Angoumois grain moth (*Gelechia cerealella*), grain beetle (*Silvanus surinamensis*), red grain beetle (*S. cassiæ*), brown grain beetle (*Tribolium ferrugineum*), and corn sap beetle (*Carpophilus fallipennis*). The use of bisulphid of carbon is advised, 1 lb. of the chemical being employed to every 100 bu. of grain in a tight granary.

Entomological observations, 1894, T. D. A. COCKERELL (*New Mexico Sta. Bul. 15, pp. 17–82, pl. 1*).—This bulletin consists of general and semitechnical notes on the entomological work pursued during the year, prefaced by some remarks on the nature of the work carried on by station entomologists. The writer states that economic study should be preceded by technical and scientific investigations, and believes that the farmers of the Territory will be benefited by the knowledge accruing from the study of the local insect fauna being carried on at the station.

Some original views are given concerning the life areas of New Mexico, the zones being named as Boreal, comprising High Alpine and Mid-Alpine, and Austral, comprising the Sub-Alpine, with subdivisions. The writer discusses this arrangement, and quotes statements from other zoögeographers holding differing opinions.

Brief notes are given on some of the beetles and stinging hymenoptera collected in the Santa Fe region, 92 and 18 species, respectively, being on record from that locality, numbers much less than those found at Wet Mountain Valley and Mesilla Valley. This inequality is believed to be due in part to insufficient collections. A number of the species are not found at all three localities. A plate reproduced from a photograph is given illustrating 8 species of insects characteristic of the Mesilla Valley.

The bulletin concludes with a diary of observations made on insects at Las Cruces from June 8 to August 22.

Spray calendar (*Delaware Sta. Special Bul. B, p. 1*).—This consists of tabulated directions for spraying various orchard and small fruits against injurious insects and fungus diseases, to which are appended formulas and directions for applying Bordeaux mixture, arsenites, hellebore, ammoniated copper carbonate, and kerosene emulsion. Special attention is called to the use of strong kerosene emulsion for the San José scale, and reporting all cases of the pest to the station at once is requested. It is urged that black knot of plum and cherry be cut off and burned as soon as discovered.

Ox warble or ox bot fly (Hypoderma bovis), T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 20, pp. 2, figs. 6*).—Brief notes on the life history of the insect.

Ascochyta pisi, an injurious parasite on peas (*Gard. Chron., ser. 3, 17 (1895), No. 437, p. 584*).

Three new species of Coccidæ, T. D. A. COCKERELL (*The Entomologist, 28 (1895), No. 383, pp. 100, 101*).—Description of 1 species from Brazil and 2 from Colorado.

Change of color in plant lice, C. GRILL (*Ent. Tidskr., 15 (1894), No. 3 and 4, p. 206*).—A brief note on some plant lice observed on chrysanthemums. To the plants was applied some India ink water for the purpose of noting the effect on the flowers, and the aphides sucked up a sufficient amount from the sap to change them from green to glistening black.

Destruction of the sheep tick (*Mitt. deut. landw. Ges., 1895, No. 8, pp. 84-86*).

Notes on ticks (Cont.) (*Agl. Jour. Leeward Islands, 1895, No. 3, pp. 57-66*).—This paper deals with remedies.

Insects on fruit trees (*Gard. Chron., ser. 3, 17 (1895), No. 437, pp. 583, 584*).

A report on the injurious insects and plant diseases of 1892, W. M. SCHÖYEN (*Christiania: Grondahl & Sons, 1893, pp. 42*).—The report of the government entomologist.

A report on the injurious insects and plant diseases of 1893, W. M. SCHÖYEN (*Christiania: Grondahl & Sons, 1894, pp. 27*).—The report of the government entomologist.

Common insect pests, T. A. WILLIAMS (*South Dakota Sta. Rpt. 1893, pp. 83-87*).—Reprinted from Bulletin 35 of the station (E. S. R., 5, p. 206).

Astreptonema longispora, a new species of Saprolegniaceæ, P. HAUPTFLEISCH (*Ber. deut. bot. Ges., 13 (1895), No. 3, pp. 83-87, pl. 1*).—A description of a new fungus parasitic on *Gammarus locusta*.

A comparative study of the odoriferous apparatus of different groups of heteropterous hemiptera, J. K. D'HERCULAIS (*Compt. Rend., 120 (1895), No. 18, pp. 1002-1004*).

On a rational nomenclature of the veins of insects, especially those of Lepidoptera, A. S. PACKARD (*Psyche, 7 (1895), May, pp. 235-241, figs. 8*).—A technical anatomical paper.

Notes on butterfly pupæ, with some remarks on the phylogenesis of the Rhopalocera, T. A. CHAPMAN (*Ent. Record, 6 (1895), No. 5, pp. 101-107; No. 6, pp. 125-130; No. 7, pp. 151-152*).—A technical paper, dealing with the anatomy and physiology of pupæ, and their morphology.

Catalogue of the Coleoptera common to North America, northern Asia, and Europe, with distribution and bibliography, J. HAMILTON (*Trans. Amer. Ent. Soc., 21 (1894), No. 4, pp. 345-416*).—This treats of 594 species, many of them of economic importance.

The Formicidæ of French Congo, E. ANDRÉ (*Rev. Ent., 14 (1895), No. 1 and 2, pp. 1-5*).—An annotated list of 36 species of ants collected in Ogoone, Africa.

A review of Scandinavian Pseudo-neuroptera, H. D. J. WALLENGREN (*Ent. Tidskr., 15 (1894), No. 3 and 4, pp. 235-270, figs. 2*).—A systematic paper, giving technical synopses and descriptions of the species.

Diptera of Colorado and New Mexico, W. A. SNOW (*Kansas Univ. Quart., 3 (1895), No. 4, pp. 225-247*).—An annotated list of 113 species, of which 13 are described as new.

Preparation and application of fungicides and insecticides, L. C. CORBETT (*South Dakota Sta. Rpt. 1893, pp. 88-92*).—Reprinted from Bulletin 35 of the station (E. S. R., 5, p. 206).

FOODS—ANIMAL PRODUCTION.

Comparison of different breeds of dairy cattle: I. The cost of milk production (*New York State Sta. Bul. 77, pp. 445-474*).—This is a continuation of the report on a test of dairy breeds in the Annual Report of the station for 1893 (E. S. R., 6, p. 1013), the data for each breed being summarized to the close of 1894. The data given are for 2 American-Holdernesses, 4 Ayrshires, 3 Devons, 4 Guernseys, 4 Holstein-Friesians, 4 Jerseys, and 1 Shorthorn, and cover from 1 to 4 periods of lactation with the different cows. An arbitrary period of lactation of 10 months is adopted for the sake of uniformity, since "this quality of persistence is an individual peculiarity rather than a breed characteristic, so far as we can yet learn; and, moreover, this quality is dependent upon several conditions and is, to some extent, under the control of the dairyman."

The cost of the food is based on the prices of the feeding stuffs at the time the investigation commenced, and these prices are uniform for all periods of lactation.

The bulletin is regarded purely as a report of progress, and readers are cautioned against drawing conclusions. "Final judgment can be rendered only when we have secured life records of a number of animals of each breed sufficient to overcome the variations of individuals and give us what may fairly represent the average of the breed."

The average data are given for each cow in each period of lactation, and these are summarized by breeds. A summary of the averages calculated to one period of lactation of 10 months is given, as follows:

Average results per period of lactation with different dairy breeds.

Breed.	Total number of periods of lactation.[1]	Average cost of food per cow for one period.	Milk.		Average percentage in milk.	Milk solids.	
			Average total yield per cow.	Average cost per pound.		Average total yield per cow.	Average cost per pound.
			Pounds.	*Cent.*	*Per cent.*	*Pounds.*	*Cents.*
American-Holderness	4	$42.90	5,721	0.76	12.66	724.1	5.93
Ayrshire	12	49.32	6,824	.74	12.74	869.4	5.68
Devon	5	37.52	3,984	.94	14.50	577.4	6.50
Guernsey	6	46.15	5,385	.86	14.93	804.0	5.73
Holstein Friesian	4	50.73	7,918	.65	11.83	936.5	5.42
Jersey	11	45.49	5,045	.90	15.37	775.4	5.87
Shorthorn[2]	2	46.22	6,055	.78	14.30	866.2	5.34

[1] I. e., 1 American-Holderness for 3 weeks and 1 for one period.
[2] Only 1 cow, 4 periods.

The financial side of the summary is given in the table following:

Average value of milk and profit per period of lactation for 1 cow.

Breed.	Average value of milk.			Profit (based on valuation of total solids).		
	With milk at 1.28 cts. per pound.	With milk solids at 9¼ cts per pound.	With milk fat at 26¼ cts. per pound	Apparent.	Actual. Skim milk at 25 cts. per 100 lbs.	Actual. Skim milk at 12½ cts. per 100 lbs.
American-Holderness	$73.22	$67 58	$50.12	$24.69	$9.08	$16.80
Ayrshire	87.24	81.14	64 17	31.73	12.67	22.20
Devon	51.00	53.89	48 27	16.37	4.37	10.37
Guernsey	68.93	75.04	75 18	28.88	13.07	20.97
Holstein-Friesian	101.35	87.41	70.07	33.65	16 16	26.40
Jersey	64 58	72.37	74.30	24.63	10 85	17.74
Shorthorn [1]	72 50	80 85	72.03	34.60	16.40	25.50

[1] Only 1 cow.

"If we take the value of all the milk produced by all the cows as calculated at 1.28 cts. per pound and divide this by the total number of pounds of milk solids produced by all the cows, then we get, as the average selling price of 1 lb. of milk solids, 9¼ cts. In other words, with milk selling at 1.28 cts. per pound, milk solids have an equivalent value of 9¼ cts. per pound. In a similar way, milk fat has an equivalent value of 26¼ cts. per pound. . . .

"It will be seen that the money value of the milk differs considerably when calculated on the basis of quantity of milk or on the amount of milk solids or of fat. In the case of milk low in solids, the basis of quantity of milk gives a higher money value than the basis of quantity of milk solids, while the reverse is true of milk high in solids or fat."

Two prices are used for calculating the value of the skim milk, a calculated value of 25 cts. per 100 lbs. and the market price of 12½ cts. The author draws no inference from the data given.

Comparison of different breeds of dairy cattle: II. The cost of butter and cream production (*New York State Sta. Bul. 78, pp. 475–503*).—A continuation from Bulletin 77 of the station (see p. 45).

"The butter production is calculated from the amount of fat in the milk as follows: From the amount of fat in 100 lbs. of milk we subtract 0.16 lb., which represents the amount of fat lost for 100 lbs. of milk in skim milk and buttermilk and in handling. The remainder is the amount of fat that goes into butter, and the amount of butter which this fat will make is found by dividing the remainder by 0.85. The result thus found is the amount of butter containing 85 per cent of fat that is made from 100 lbs. of milk."

The bulletin gives the average data for each cow in each period of lactation, together with summaries of breeds. The principal averages

of the calculated butter product of the several breeds are given in the following table:

Average calculated yield and value of butter per cow for one period of lactation.

Breed.	Fat.		Butter.			Financial result.	
	Average fat content of milk.	Average total yield per period.	Average yield per period (calculated).	Milk required to make 1 lb of butter.	Cost of food per pound of butter.	Value of butter product at 25 cts. per pound.	Average profit per cow.
	Per cent.	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*		
American Holderness	3.73	213.1	239.9	23.80	17.90	$59.98	$17.08
Ayrshire	3.60	244.8	275.2	21.70	17.92	68.80	19.48
Devon	4.60	183.3	208.4	19.15	18.00	52.10	14.58
Guernsey	5.30	285.5	325.6	16.53	14.15	81.40	35.25
Holstein-Friesian	3.36	266.1	298.1	26.60	17.02	74.53	23.80
Jersey	5.60	282.1	322.4	15.63	14.11	80.60	35.11
Shorthorn	4.14	269.0	305.1	19.84	15.15	76.28	30.06

The data for the cream are calculated similarly to those for butter, assuming the cream to contain 20 per cent of fat. The averages by breeds follow:

Average calculated yield and value of butter per cow for one period of lactation

Breed.	Average total yield per period	Milk required to make 1 lb of cream	Average cost of food per pound of cream.	Value of cream per cow at 20 cts per quart.	Average profit per cow from selling cream.	
					Apparent.	Actual.[1]
	Pounds	*Pounds*	*Cents.*			
American Holderness	1,065.5	5.37	4.03	$101.00	$58.10	$57.03
Ayrshire	1,224.0	5.58	4.03	116.02	66.70	65.48
Devon	916.5	4.35	4.09	86.86	49.36	48.44
Guernsey	1,427.5	3.80	3.23	135.27	89.12	87.70
Holstein Friesian	1,330.5	5.95	3.81	126.10	75.37	74.04
Jersey	1,410.5	3.60	3.22	133.70	88.21	86.80
Shorthorn	1,345.0	4.50	3.44	127.48	81.27	79.92

[1] Deducting value of fertilizing materials carried away.

The bulletin concludes with a table showing the relative results for butter and cream with different breeds, arranged on a basis of 100.

Comparison of different breeds of dairy cattle: III. Cost of cheese production (*New York State Sta. Bul. 79, pp. 505–526*).—This is a continuation from Bulletin 78 of the station (see p. 46). The average data are given for each of the cows included in the test in each period of lactation, and these data are summarized by breeds. The average composition of the milk, the yield of fat and casein, and the calculated yield of green cheese are tabulated, together with the cost of cheese per pound based on the cost of the food plus 12½ cts. per 100 lbs. of milk as the value of materials sold off the farm.

"Our work justifies us in saying that we can find the yield of green cheese from 100 lbs. of any milk by multiplying the per cent of fat by 1.1 lbs. and the per cent of casein by 2.5 lbs. and adding together the two products. . . .

"In calculating the amount of cheese that can be made from the milk of different cows we have made use of this rule, and are confident of presenting much more con-

sistent and reliable results than we could possibly secure by attempting to make cheese with the small amounts of milk at hand."

The average data for each breed, based on 1 cow and a period of lactation of 10 months, are given in the following table:

Average yield and value of cheese per cow for one period of lactation.

Breed.	Average fat content of milk.	Average product per cow for one period. Fat produced.	Casein produced.	Green cheese.	Average amount of milk required to make 1 lb. of green cheese.	Amount of cheese for 1 lb. of fat in milk.	Financial result for 1 cow and one period of lactation. Average cost of cheese per lb.	Value of cheese at 9¾ cts. per lb.	Average profit.
	Per ct.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*		
American-Holderness	3.73	213.1	139.3	582.7	9.82	2.73	7.36	$56.33	$5.62
Ayrshire	3.60	244.8	164.7	681.1	10.02	2.77	7.24	65.84	7.00
Devon	4.60	183.3	112.1	481.9	8.27	2.63	7.78	46.58	3.06
Guernsey	5.30	285.5	155.4	702.6	7.66	2.46	6.57	67.92	13.87
Holstein-Friesian	3.36	266.1	185.0	755.2	10.48	2.84	6.72	73.00	12.02
Jersey	5.60	282.1	150.8	687.3	7.34	2.43	6.62	66.44	13.42
Shorthorn	4.44	269.0	172.9	728.2	8.31	2.71	6.35	70.39	15.06

The relation of the fat in the milk to the yield of green cheese is shown separately for each cow in each period of lactation. This shows "that there is more or less variation in the relation of fat to cheese yield, but that the results are fairly uniform within certain limits." To show this relation more plainly the cows are grouped according to fat content of the milk in the following table:

Relation of fat in milk to yield of cheese.

Group.	Fat in milk.	Amount of green cheese made from 100 lbs. of milk.	Amount of green cheese made for 1 lb. of fat in milk.
	Per cent	*Pounds.*	*Pounds.*
1	2.80 to 3.00	8.67	2.98
2	3.00 to 3.25	8.95	2.80
3	3.25 to 3.50	9.47	2.76
4	3.50 to 3.75	10.10	2.76
5	3.75 to 4.00	10.66	2.70
6	4.00 to 4.25	11.95	2.82
7	4.25 to 4.50	11.69	2.72
8	4.50 to 4.75	11.64	2.58
9	4.75 to 5.00	12.04	2.46
10	5.00 to 5.25	12.61	2.45
11	5.25 to 5.50	13.14	2.44
12	5.50 to 5.75	13.89	2.44
13	5.75 to 6.00	14.20	2.44
14	6.00 to 6.25	15.24	2.50

"An examination of the foregoing tabulated summary reveals some very interesting facts:

"(1) In milk containing less than 3 per cent of fat the cheese yield for 1 lb. of fat is much higher than the average.

"(2) In milk containing from 3 to 4.5 per cent of fat the amount of cheese made for 1 lb. of fat is quite uniform, and the average is nearly the same as that secured in all our previous work at cheese factories. These are the limits within which the per cent of fat of most cheese factory milks fall. These results agree in a surprising way with those secured in our most extended investigations, especially when we consider that these are results obtained with individual cows instead of herds.

"(3) In milk containing 5 to 6 per cent of fat or more the amount of cheese made for 1 lb. of fat was noticeably less than in milk containing 4.5 per cent of fat or less, but in milk containing 5 per cent of fat or more up to 6.13 per cent of fat we have very uniform results, so that these data point to the fact that milk containing 6 per cent or more of fat will yield as much cheese per pound of fat as will milk containing less than 6 per cent of fat down as low as 5 per cent."

Referring to the first table above it will be seen that the amount of milk required per pound of cheese was least for the Jersey and greatest for the Holstein-Friesian milk. Taking these extremes the effect of paying for the milk by weight and on the basis of fat content are compared.

Results of paying for milk by different methods.

Herd.	Fat in milk	Amount of cheese made from 100 lbs. of milk.	Amount of cheese made for 1 lb of fat in milk.	Value of 100 lbs. of milk based on milk fat at 25 cts. per pound.	Value of 100 lbs. of milk based on cheese made at 9⅝ cts. per pound.	Value per 100 lbs. of milk based on weight alone.
	Per cent	*Pounds*	*Pounds*			
Holstein Friesian	3.36	9.54	2.84	$0.84	$0.92	$1.12
Jersey	5.60	13.62	2.43	1.40	1.32	1.12

"A study of the above figures leads to the following statements:

"(1) Comparing results of paying on basis of fat and on basis of actual cheese yield with these two herds, whose milk differs as the milk of no two herds of cheese factory cows differs for a whole season's average, we see that the poorer milk receives 8 cts. more per 100 lbs. on the basis of actual cheese than on basis of fat, while the milk richer in fat receives that much less.

"(2) If the cheese made from the richer milk sold for one-half cent more per pound than the other, then the fat basis would be absolutely fair. Would the cheese made from the richer milk differ in composition enough to make the difference of one half cent per pound? The following would represent the composition of the cheese made from these two milks:

Composition of cheese.

Herd.	Fat in cheese.	Casein in cheese.	Water, salt, etc., in cheese.
	Per cent	*Per cent.*	*Per cent.*
Holstein Friesian	35.24	24.50	40.26
Jersey	41.05	21.94	37.06

"It is clear from these figures that the cheese made from the two kinds of milk differs much in composition, since that made from the richer milk contains nearly 6 per cent more of fat. Allowing that the cheese was made with equal skill, it is safe to say that the richer cheese would sell easily for a half cent more per pound.

"(3) If the milk of each herd was paid for by weight alone, then each would receive the same amount, or one-half the total receipts, which would give $1.12 to each milk.

"(4) If the cheese sold for different prices, as indicated above, then the fat basis would be strictly just and, as between this method and the method of paying by weight alone, the poorer milk would receive 28 cts. more and the richer milk 28 cts. less than each ought per 100 lbs. of milk. But, granting that the cheese would all

sell at one price, what would be the comparative justice of the fat basis and the basis of weight alone? On the basis of the fat the richer milk would receive 8 cts. more per hundred than its cheese yield would entitle it to. On the other hand, on the basis of weight alone, the poorer milk would receive 20 cts. more than it ought.

"Where the differences in composition of milk are less the chance of doing any possible injustice in paying on basis of fat becomes proportionately less or practically disappears."

The average composition of the cheese made from the milk of each breed is tabulated.

Investigations of the milk of 16 thoroughbred Dutch cows during one period of lactation, K. HITTCHER (*Landw. Jahrb., 23 (1894), No. 6, pp. 873-967*).—In 1891 Prof. W. Fleischmann published a record of observations on a herd of 145 Dutch cows bred in East Prussia, covering one year with special reference to the milk of 16 cows which were in the same stage of the milking period (E. S. R., 3, p. 424). The present paper reports a continuation of these studies under the advice of Professor Fleischmann by his assistant in the former investigation, the period covered being one period of lactation. As in the previous year, samples of the milk were sent three times a week to Professor Fleischmann's laboratory at Königsberg for analysis.

Observations on the entire herd.—There were at the royal domain of Kleinhof-Tapiau during the year 144 cows, the average number in milk at all times being 124. The average length of the period of lactation was 314 days. The average yield of milk per cow was 2,786 kg. during the year, or 8.81 kg. daily.

The cows were placed on stall feeding with the beginning of the investigation, October 1, and, as was customary, were divided into 2 general lots, lot A including all the cows which had not reached the last quarter of their period of lactation, and lot B those which were old in milk or dry or were to be fattened. Lot A received per cow daily 4.25 kg. of grain, consisting of 1 kg. of meal (rye, oats, barley, and peas), 1 kg. of coarse wheat bran, 1 kg. of malt sprouts, 0.75 kg. of sunflower cake, 0.25 kg. of peanut meal, and 0.25 kg. of palm nut cake, to which was added at different times hay, straw, potato slump, and grass and serradella silage. Besides this, each cow had 30 gm. of salt and 30 gm. of phosphate of lime per day. Lot B received per head 5 kg. of hay, 2 kg. of straw, 1.25 kg. of wheat bran, and 0.75 kg. of sunflower cake. Early in May both lots were turned to pasture and remained there to the close of the period covered.

The milking commenced at 4 in the morning and between 4.30 and 5.30 at night, so that the longest interval was always during the day. At all seasons of the year the milk yield was larger at night, the average difference being 0.4 kg. per cow daily. The morning's milk was 0.065 per cent richer in fat and 0.046 per cent richer in total solids than the night's milk, and the percentage of fat in the total solids was 0.43 higher; but the specific gravity and the solids-not-fat were both slightly lower in the morning's milk.

The following table shows the average composition of the mixed milk of the whole herd for the year, and the ranges in composition of the herd milk for the day (mixed morning's and night's milk), and for separate milkings (morning's or night's):

Average and range of composition of herd milk for 1 year.

	Specific gravity	Total solids	Fat	Solids not fat
		Per cent	*Per cent*	*Per cent*
Average for the year	1 03086	11 952	3 312	8 640
Mixed milk of day				
Minimum	1 03021	11 601	3 022	8 491
Maximum .	1 03145	12 369	3 609	8 786
Separate milkings				
Minimum . .	1 02980	11 491	2 940	8 422
Maximum ..	1 03160	12 484	3 864	8 852

The minima observed for the mixed herd milk for 3 years at this estate, always on thoroughbred Dutch cows, were as follows:

Minima for mixed milk of herd by years

Year	Specific gravity	Total solids	Fat	Solids not fat	Maximum specific gravity of solids
		Per cent	*Per cent*	*Per cent*	
1889 90 .	1 0298	11 491	2 940	8 422	1 351
1888 89 .	1 0291	11 125	2 705	8 283	1 361
1887 88 .	1 0295	11 091	2 591	8 211	1 374

In 1889–90 the variation in composition was greater during the winter than during the summer, which is the reverse of the case in the two preceding years. For 10 days before the cows were turned to pasture the average per cent was 9.48 kg. of milk with 3.23 per cent of fat, and for 2 weeks after the change it was 11.35 kg. of milk with 3.199 per cent of fat. That is, when the cows were turned to pasture the milk yield increased perceptibly, but the fat content decreased slightly. The latter was relative as well as absolute, since the percentage of fat in the total solids was 27.38 before and 27.08 after pasturage began. In the two preceding years not only the milk yield, but both the absolute and relative fat content increased in changing from stall to pasture feeding. It is suggested that the difference may have been due to the cows receiving a richer stall feeding in 1890. The maximum milk yield was reached May 28, being 12.24 kg. per cow.

Observations on 16 cows.—As in the previous year, cows were selected which calved at nearly the same time, most of them in March or early in April. Five of the cows had been used the previous year; 6 were prize cows. The length of the milking period of these cows ranged from 270 to 461 days, but for most of them it was not far from 300 days.

The quantity of colostrum given at the first milking after calving varied widely, ranging from 1 to 7.9 kg., and the fat content equally widely, from 1.73 to 7.75 per cent. In the following table the cows are

divided into 2 groups, according to the fat content of the colostrum, and this compared with the fat content of the milk afterwards given (average for whole period of lactation):

Fat content of colostrum and of milk of 13 cows.

Richer colostrum			Poorer colostrum.		
Number of cow.	Fat content of colostrum.	Average fat content of milk.	Number of cow.	Fat content of colostrum.	Average fat content of milk.
	Per cent.	*Per cent.*		*Per cent*	*Per cent.*
480	7.75	3.048	407	4 42	3.356
446	7.20	3.122	429	4 23	3.161
490	5.96	3.478	403	3.76	2.703
31	5 85	3.160	373	3 36	2.978
470	5.75	3.154	419	3.12	2 762
345	5.12	3.147	413	1 73	2.651
469	4.86	3.139	Average	3.44	2.802
Average	6 07	3 178			

Where calves were allowed to run with the cows it was expected that the little milk that was left would become rich in fat, as is the case with the last part of the milking; but quite the contrary was often observed, which suggests to the author that the calf can get the fat from the udder more thoroughly than hand milking.

Striking instances are mentioned of the disturbing influence of removing the calf. A cow whose calf was taken away in the forenoon gave that night only 1.7 kg. of milk with 0.45 per cent of fat, and the the following morning 5.9 kg. of milk with 0.72 per cent of fat; 24 hours later the yield was 7.5 kg. with 5.6 per cent of fat. Another cow which had been giving milk with 4.67 per cent of fat, gave 2.4 kg. of milk with only 0.65 per cent of fat the night after the calf was taken away, and 7.1 kg. with 1.27 per cent of fat the next morning; but the following evening the milk was normal. This was noticed with several cows, but in the case of one the milk was richer. Cows in heat frequently decreased in milk, and the milk was very poor in fat (0.17 and 0.47 per cent), though in one case the milk became richer. The composition of the milk at the end of the milking period, when the cows were being milked only once in 3 or 4 days, is given as follows:

Milk produced when the cows were practically dry.

Number of cow.		Milk yield.	Specific gravity.	Fat content.	Average fat content for whole period.
		Kg.	*Deg.*	*Per cent.*	*Per cent.*
373	Last milking	0 4	47.0	1.60	2.978
407	.....do	.3	31 1	.90	3.356
429	.....do	.9	38.0	1.22	3.161
446	.....do	.8	45.2	2.98	3.122
465	.....do	3.3	30.0	1.72	3.046
469	.....do	.8	37 2	1.80	3.139
470	.....do	1.8	25.1	4.56	3.154
470	Next to last milking	3.0	28.6	7.78	3.154
480	Last milking	.2	52.0	1.72	3.048
490	.....do	.5	38.3	10.21	3.478

Nine cows, which were milked morning, noon, and night for a time after calving, gave the most in the morning and the least at night, and the fat content was just the opposite to the yield as a rule. These cows gave 2.16 per cent more milk and 13.08 per cent more butter fat when milked 3 times a day than when milked twice, and they continued to shrink for 8 days after the change to milking twice. The monthly averages and the variations are given for each cow for the whole period of lactation and illustrated graphically by curves. A summary of these data is given in the 3 following tables:

Average milk yield per day by months.

Number of cow.	Number of month of lactation period.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Kg	*Kg*	*Kg.*	*Kg*	*Kg*	*Kg*	*kg.*	*Kg*	*Kg*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
31	10.42	[1]10.08	10.05	8.46	8.44	7.40	[2]5.56	3.90	1.77	...	...	...	...	...
345	11.14	[1]11.88	14.45	11.32	11.48	10.09	[2]8.19	7.46	6.82	6.15	6.23	...	...	...
373	17.15	15.30	[1]16.10	17.19	14.20	14.73	12.74	[2]10.04	9.04	6.66	3.59	...	...	...
403	20.38	18.47	14.37	[1]15.75	16.65	13.65	14.15	12.08	[2]9.48	8.89	7.96	7.58	7.42	6.51
407	19.19	15.38	[1]14.09	14.29	11.56	11.65	10.27	[2]8.93	6.26	2.46	...	...	...	...
413	18.74	14.48	[1]12.46	13.16	10.34	11.56	10.28	[2]8.81	8.14	6.89	6.40	6.08	...	...
419	18.32	12.78	[1]13.33	14.59	12.53	13.16	11.20	[2]9.63	9.04	7.26	6.38	5.73	4.20	...
429	21.05	17.84	[1]16.92	19.20	16.09	16.37	14.06	[2]10.75	9.39	7.72	6.12	3.21	1.34	...
446	18.17	[1]21.91	20.52	17.08	16.24	14.55	[2]10.46	10.61	6.29	3.11	1.40	...	...	...
451	16.18	14.34	[1]14.32	14.70	12.77	12.20	10.53	[2]7.99	7.25	6.40	6.40	6.29	...	...
465	16.35	13.65	[1]14.22	16.05	12.85	12.03	11.12	[2]8.65	9.03	7.36	6.12	2.88	...	...
469	14.44	14.14	[1]13.67	14.82	12.28	13.11	11.08	[2]8.13	6.64	3.67	...	...	...	...
470	16.99	[1]17.29	17.58	11.85	14.69	13.01	[2]9.54	9.79	8.16	3.94	...	...	...	...
480	16.98	13.82	[1]14.09	15.41	11.94	13.41	10.98	[2]6.74	5.62	1.92	...	...	...	...
[3]483	14.48	[2]13.80	11.93	11.28	10.19	10.02	9.58	9.02	[1]8.99	9.43	7.81	8.18	7.08	[2]5.65
490	16.62	18.58	[1]18.48	16.33	13.38	13.65	11.20	[2]8.79	9.06	6.07	3.05	...	...	...

[1] Turned to pasture May 14. [2] Stall feeding commenced October 4 [3] Calved September 23.

Average total solids in milk by months.

Number of cow.	Number of month of lactation period													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Per cent.	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
31	12.58	[1]12.08	11.87	11.84	11.91	12.26	[2]12.14	12.01	12.47	...	...	...	...	...
345	11.73	[1]11.94	11.99	11.59	11.69	11.82	[2]11.62	11.56	11.79	11.98	12.04	...	...	...
373	12.17	11.18	[1]11.42	11.64	11.59	11.63	11.68	[2]11.49	11.58	12.15	12.58	...	...	...
403	13.35	11.51	11.04	[1]11.35	11.20	11.22	11.04	11.16	[2]11.05	10.95	11.10	11.23	11.19	11.40
407	12.52	11.56	[1]11.97	12.13	12.12	12.21	12.20	[2]11.93	11.97	11.64	...	...	...	...
413	12.06	10.73	[1]10.89	10.84	10.75	10.83	10.87	[2]10.62	10.66	10.74	10.68	10.86	...	...
419	11.06	10.18	[1]10.69	10.99	10.89	10.83	11.10	[2]10.62	10.27	10.39	10.58	10.91	11.80	...
429	11.82	11.23	[1]11.63	11.78	11.71	11.75	11.74	[2]11.46	11.52	11.62	11.56	11.69	...	...
446	12.99	[1]11.82	11.79	11.36	11.30	11.26	[2]11.12	11.53	12.54	13.14	13.99	...	...	...
451	12.82	11.74	[1]11.89	12.27	12.35	12.40	12.51	[2]12.40	12.48	12.94	12.81	13.04	...	...
465	12.04	10.81	[1]11.28	11.42	11.36	11.45	11.52	[2]11.44	11.34	11.79	12.31	12.84	...	...
469	11.92	11.19	[1]11.51	11.69	11.67	11.87	12.27	[2]12.33	12.28	13.23	...	...	...	...
470	12.42	[1]11.81	11.68	11.48	11.63	11.83	[2]11.79	11.65	12.17	13.50	...	...	...	...
480	12.63	11.21	[1]11.41	11.48	11.17	11.32	11.79	[2]11.43	12.44	13.04	...	...	...	...
[3]483	12.85	[2]11.03	10.70	10.73	10.73	10.93	10.94	10.61	[1]10.84	11.05	10.99	11.10	11.30	[2]11.08
490	14.82	12.04	[1]11.47	11.67	11.65	11.66	12.17	[2]12.22	11.89	13.10	15.20	...	...	...

[1] Turned to pasture May 14. [2] Stall feeding commenced October 4. [3] Calved September 23.

Average fat content of milk by months.

Number of cow.	Number of month of lactation period.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
31	3.35	[1]3.17	3.01	3.05	3.08	3.41	[2]3.13	2.91	3.34	......	......	......	......	....
345	3.07	[1]3.32	2.24	3.08	3.11	3.29	[2]3.13	2.93	3.01	3.16	3.18	......	......	....
373	3.20	2.78	[1]2.88	2.89	2.98	3	3.11	[2]2.93	2.88	3.26	3.51	......	......	....
403	4.22	3.01	2.70	[1]2.79	2.51	2.68	2.49	2.69	[2]2.48	2.25	2.32	2.45	2.43	2.78
407	3.39	3.08	[1]3.31	3.28	3.45	3.52	3.62	3.38	3.29	3.14	......	......	......	....
413	3.31	2.60	[1]2.72	2.59	2.59	2.67	2.71	[2]2.48	2.40	2.41	2.40	2.51	......	....
419	2.80	2.-47	[1]2.67	2.83	2.87	2.73	3.02	[2]2.74	2.45	2.53	2.74	2.89	3.59	....
429	3.30	2.90	[1]3.19	3.17	3.26	3.20	3.31	[2]3.07	3.01	3.09	3.10	3.31	......	....
446	3.78	[1]3.16	3.12	2.93	2.94	3.09	[2]2.97	2.88	3.34	3.89	3.82	......	......	....
451	3.67	3.18	[1]3.23	3.40	3.58	3.58	3.80	[2]3.55	3.47	3.78	3.66	3.90	......	....
465	3.52	2.74	[1]2.92	2.82	2.92	3.02	3.18	[2]3.13	2.90	3.06	3.29	3.84	......	....
469	3.15	2.72	[1]2.96	2.95	3.06	3.22	3.55	[2]3.47	3.31	3.97	......	......	......	....
470	3.37	[1]3.14	2.94	2.89	3.01	3.24	[2]3.24	3.01	3.40	4.77	......	......	......	....
480	3.75	2.84	[1]2.92	2.88	2.79	2.80	3.13	[2]3.35	3.35	3.71	......	......	......	....
[3]483	3.37	[2]2.72	2.56	2.55	2.63	2.70	2.76	2.58	[1]2.76	2.81	2.80	2.79	2.98	[2]2.80
490	5.24	3.50	3.12	3.17	3.21	3.20	3.06	[2]3.57	3.25	4.08	5.66	......	......	....

[1] Turned to pasture May 14. [2] Stall feeding commenced October 4 [3] Calved September 23.

The milk yield of most of the cows increased materially in June (the month after turning to pasture) and somewhat in August, after the cows were changed to a fresh pasture. As a rule, the yield began to decrease after the third to fifth month, although the decrease by months is irregular. The natural shrinkage is undoubtedly concealed by the change of feed and other conditions.

The percentage of solids, except in the case of cow No. 345, diminished in the first weeks of lactation, and, except in the case of cow No. 407, increased in the later months of lactation. The curve for solids follows the curve for fat quite closely, as was the case the previous year.

The fat content increased with advancing lactation in the case of 10 cows, although but slightly in the case of 3; while with 6 cows it decreased, materially in the case of 4. In the previous year the fat content increased materially with all the cows except one which was over 12 years old. Cows Nos. 413, 451, 469, 470, and 480 were under observation the previous year. While the milk of all increased in fat content the previous year, the present year this was not true for Nos. 413 and 480.

The highest average fat content for the whole period, 3.52 per cent, occurred in the milk of cow No. 451, which averaged 12.41 per cent of solids, also the highest.

Cow No. 483 was included because she was a daughter of No. 413, which in the previous year's trial had shown the lowest average fat content, 2.63 per cent, and also a low yield. The average for No. 483 the present period was 2.73 per cent of fat and 10.96 per cent of solids, showing that the characteristic of producing poor milk had been transmitted from the dam to her offspring.

The following table gives some important data as to the cows and the relation between the weight of each cow and the yield of milk and butter:

Summary for entire period of lactation, showing relation between live weight and the yield of milk and butter.

Number of cow.	Number of period of lactation.	Length of present period of lactation	Average live weight.	Total yield of—		Yield of products for each kilogram of live weight.		Yield per 1,000 kg live weight.			
								Total for period.		Average per day.	
				Milk.	Butter[1]	Milk.	Butter.	Milk.	Butter.[1]	Milk.	Butter[1]
		Days.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
31	2	270	526	2,031.86	77	3.86	0.15	3,862.9	146.38	14.31	0.54
345	7	330	614	3,155.12	119	5.14	.19	5,139.0	193.85	15.57	.59
373	9	315	555	3,984.58	142	7.18	.25	7,180.3	255.88	22.79	.81
403	6	408	571	4,899.70	159	8.58	.28	8,579.4	228.41	21.03	.68
407	5	289	606	3,281.16	132	5.41	.28	5,414.5	217.82	18.73	.75
413	7	354	552	3,677.10	117	6.66	.21	6,662.9	212.00	18.82	.60
419	5	399	575	4,263.63	141	7.41	.24	7,414.3	245.20	18.58	.61
429	5	370	611	4,797.77	182	7.85	.30	7,852.3	297.87	21.22	.80
446	3	294	569	3,974.94	149	6.99	.26	6,987.8	261.94	23.77	.89
451	4	356	565	3,799.16	161	6.72	.28	6,724.5	284.97	18.89	.80
465	4	353	530	3,933.09	144	6.42	.27	7,420.9	273.58	21.02	.77
469	4	301	537	3,391.91	128	6.31	.2[illegible]	6,315.7	238.34	20.98	.79
470	3	293	575	3,792.45	144	6.59	.25	6,595.2	250.42	20.51	.85
480	3	287	481	3,205.30	117	6.66	.24	6,663.8	243.24	23.22	.84
483	3	461	519	4,061.08	133	7.82	.26	7,821.7	256.16	16.96	.55
490	2	303	517	3,761.24	157	7.27	.30	7,274.1	303.64	24.01	1.00

[1] With 83.33 per cent fat, calculated.

It will be seen that the yield of milk during the milking period amounted to from 3.86 to 8.58 times the weight of the cow, while that of butter amounted to from 0.15 to 0.3 of the live weight. When the yields are calculated to a uniform live weight of 1,000 kg. the differences are less striking; and when in addition to this they are calculated to a uniform lactation period of 300 days (table given in the original) the range is somewhat smaller—milk 2,146 to 3,601 kg. and butter 81 to 150 kg. The relation between the highest and lowest butter yield is still 100 : 185.

These figures emphasize the wide difference there may be in the value for dairy purposes of cows of the same breed, the same herd, the same live weight, the same length of milking period, and receiving the same food and treatment.

The yields are also compared with reference to age and to live weight. The former was irregular; the lighter cows yielded the most in proportion to their weight.

An arrangement of the cows according to age shows that this factor is of secondary importance in connection with the composition of the milk. It is true that in general the 8 older cows gave milk with a lower average fat content than the 8 younger, but individuality was the factor of first importance. In general the cows giving the largest yield of milk and butter during the period gave the richest milk in both solids and fat, and *vice versa.*

Arranging the cows into 4 groups according to the average composition of the milk for the entire period of lactation, it is shown that with an increase in fat there was an increase in solids, and that the increase of fat was also relative; for the proportion of fat in the total solids in the 4 groups was 24.70, 26.12, 26.47, and 28.07 per cent, the latter corresponding to the richest milk.

Summary.—The results of the investigations during 2 years agreed on the following points:

(1) The percentage of solids and of solids-not-fat in the milk rose and fell with the percentage of fat.

(2) Those cows which gave milk richest in fat content likewise gave milk with a higher percentage of fat in the total solids (relatively richer in fat).

(3) To a certain extent, with high feeding the cows which gave milk rich in fat also gave a large quantity of milk, which is contrary to the general belief in practice.

(4) The fat showed much the greatest fluctuation (in proportion to its amount) of all the constituents in the case of all the cows.

(5) The specific gravity of the milk of individual cows was invariably directly proportional to the content of solids not fat.

The following deductions were made from the present investigations (one year):

(1) By the method of milking commonly practiced the fat is not so readily drawn from the udder as by the suckling of the calf.

(2) The increase in milk and fat yield of 9 cows when milked three times daily as compared with milking twice was not so large, on the average, as is generally supposed to be the case in practice.

(3) The belief held by some dairymen that cows which do not calve every year will make up for the loss in the next period of lactation, was not always confirmed in the cases under observation.

(4) The individual characteristics of cows as to the yield of milk or butter is in a large degree transmitted.

Effect of dehorning, J. H. SHEPPERD (*North Dakota Sta. Bul. 16, pp. 73, 74*).—Fourteen cows were dehorned with dehorning clippers and the effect noted on the yield and composition of the milk. No data are tabulated, but the following statements are made:

"The cows were dehorned just before the evening milking, so that the full effect of the excitement might be noted. Most of them fell off in the yield of milk at the first milking after being dehorned, but their milk tested higher in fat, in the majority of cases, than it did at the previous milking, owing probably to the excitement occasioned by it. All of the cows were back to their normal milk flow by the fourth milking after dehorning. Some of them showed very little difference even in the first milking, and the more highly developed their nervous systems the larger the effect noticed. . . .

"Summarizing for both lots, 14 cows, we have 0.84 lb. less fat, or about a pound less butter on the 2 days following than on the 2 days before the horns were removed."

Alfalfa forage for milch cows (*New York State Sta. Bul. 80, pp. 527-576*).—Accounts are given of some 14 different trials in which alfalfa fodder was fed to cows in comparison with other green fodders, supplemented by hay and grain. In each case the composition is given of feeding stuffs used, the average composition of the milk, the average yield of milk and milk constituents, the amounts of food ingredients consumed, and the cost of food per pound of milk and milk ingredients. The latter is based upon a constant set of prices for the feeding stuffs used, which is as follows:

"Wheat bran $18, corn meal $20, ground oats $25, old-process linseed meal $27 new-process linseed meal $25, gluten meal $25, wheat middlings $20, cotton-seed meal $30, gluten feed $18, ground flaxseed $60, hay $10, corn silage $3, roots $3, and all green fodder crops $2 per ton."

In 1891, 3 trials were made. The first of these was with 14 cows and lasted from May 15 to July 15, the time being divided into 4 equal periods. Corn silage was fed the first period, corn silage and alfalfa fodder the second period, alfalfa fodder the third period, and oat-and-pea fodder during the fourth period. The average results per cow follow:

Comparison of alfalfa fodder with oat and-pea fodder, corn silage, etc., for cows.

	Food per day.		Yield per day of—		Fat content of milk.	Dry matter eaten per pound of—		Cost of food per pound of milk.
	Total digestible nutrients.	Nutritive ratio	Milk	Total solids.		Milk.	Total solids.	
	Pounds		*Pounds.*	*Pounds.*	*Per cent*	*Pounds*	*Pounds.*	*Cent*
Corn silage	10.35	1:5.7	16.64	2.27	4.03	1.02	7.49	0.83
Corn silage and alfalfa fodder........	11.49	1:5.4	17.31	2.39	4.10	1.08	7.80	.79
Altalfa fodder .	12.14	1:4.7	17.19	2.08	3.66	1.15	9.50	.77
Oat-and pea fodder .	11.38	1:5.1	16.67	2.24	4.10	1.11	8.24	.81

"The greatest amount of organic matter was in the ration for the third period, when the largest amount of alfalfa was fed, and the cost of the ration was somewhat the lowest. The ration contained the largest amount of digestible protein and the nutritive ratio was the narrowest, that of 1:4.7. The cost of food for weight of milk produced was lowest during the third period and the cost of fat the highest. The greatest amount of digestible fat was contained in the ration for the second period and the most fat was produced in the milk. The cost of fat produced was lowest during the second period."

The other 2 trials in 1891 extended from August 1 to October 15, and were apparently with the same cows, so that the results are here combined. The time was divided into equal periods, but as the green ration

was changed in the last period when corn fodder was fed that period is here omitted. The average results follow:

Comparison of alfalfa fodder with barley-and-pea fodder, etc., on cows.

	Food per day.		Yield per day of—		Fat content of milk.	Dry matter eaten per pound of—		Cost of food per pound of milk.
	Total digestible nutrients.	Nutritive ratio.	Milk.	Total solids.		Milk.	Total solids.	
	Pounds.		*Pounds*	*Pounds.*	*Per cent*	*Pounds.*	*Pounds.*	*Cent.*
Corn silage and alfalfa fodder	11 36	1:5.9	18.05	2.33	3.49	0.96	7.44	0 70
Corn silage and timothy fodder	11.87	1:6.9	15.98	2.09	3.88	1.09	8 35	.78
Barley-and pea fodder	12.93	1:5.3	14 56	1.92	4.12	1.37	10.35	.90
Alfalta fodder	11.22	1:4.6	14.71	2 00	4.21	1.25	9.19	.86

"In the change from the first period to the second, when timothy fodder was substituted for alfalfa fodder, there was considerably more than the normal decrease of milk yield, although the total food consumed was about the same. . . .

"The cost of the second ration was somewhat less, but the cost of production of milk and its constituents was somewhat more than for the first period. By a change to barley-and-pea fodder and hay in the third ration . . . there was considerable decrease in the milk yield, however, although not so much as followed the first change. The cost of milk, of milk solids and fat, was somewhat greater for the third period. . . .

"In changing from the ration with barley-and pea fodder to that with alfalfa fodder . . . there was no falling off in the milk yield, but on the contrary a slight increase. The composition of the milk remained about the same, the slight change being toward improvement in quality."

In 1892, 3 trials were made. The first was with 14 cows and lasted from May 15 to July 15. Hay and corn silage were fed during the last half of May, alfalfa fodder during the whole of June, and oat-and-pea fodder during the first half of July. The results are summarized below:

Comparison of alfalfa with oat-and-pea fodder and corn silage on cows.

	Food per day.		Yield per day of—		Fat content of milk.	Dry matter eaten per pound of—		Cost of food per pound of milk.
	Total digestible nutrients.	Nutritive ratio.	Milk.	Total solids.		Milk.	Total solids.	
	Pounds.		*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds*	*Cent.*
Hay and corn silage.	11.18	1:7.1	20.86	2.90	4.09	0.93	6.68	0.69
Alfalfa fodder	11.91	1:6.2	21 20	2.89	3 87	.91	6.66	.70
Oat and-pea fodder .	15.67	1:8.1	20.72	2.75	3.61	1.13	8.52	.74

"In changing from the ration of the first period to that of the second the yield of milk increased somewhat; but the amount of the different constituents remained the same, although there was a slight decrease in the per cent of fat. The cost of milk was about the same as for the first period and the cost of fat somewhat higher. . . .

"[In the third period] there was about the normal decrease in milk yield, but accompanied by a slight falling off in total solids, more noticeable in the per cent of fat. The cost of milk and fat production was greater in the third period."

The 2 other trials in 1892 were each with 10 cows. The first continued through August, and the second from September 1 to October 15. The grain ration was the same throughout both trials except in the last period (corn silage), when it was changed to one somewhat richer in protein. The results for the 2 trials are summarized below:

Comparison of alfalfa fodder with oat-and-pea fodder on cows.

	Food per day.		Yield per day of—		Fat content of milk.	Dry matter eaten per pound of—		Cost of food per pound of milk.
	Total digestible nutrients.	Nutritive ratio.	Milk.	Total solids.		Milk.	Total solids.	
	Pounds.		*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds.*	*Cent.*
Alfalfa fodder	13.75	1:7.1	21.71	2.76	3.71	1.03	8.09	0.66
Oat and pea fodder .	12.88	1:8.1	19.18	2.54	3.82	1.03	7.71	.75
Oat and pea fodder .	14.18	1:8.2	19.70	2.52	3.49	1.11	8.69	.80
Alfalfa fodder	12.44	1:5.2	19.74	2.45	3.26	1.03	8.30	.75
Corn silage[1]	14.04	1:8	18.75	2.45	3.82	1.21	9.29	.91

[1] Grain ration changed.

"In the second period there was considerable falling off in the milk yield and in the amount of the milk constituents, although there was a slight improvement in the quality of the milk. The cost of milk and solids was increased. . . .

"In changing from oat-and-pea fodder to alfalfa fodder the nutritive ratio of the ration was made much narrower. There was a decrease in the total cost of the food, but the milk yield remained about the same. The per cent of fat in the milk was less. The cost of production was lower for milk and for total solids. The cost of fat produced was almost exactly the same. In changing from alfalfa fodder to corn silage, although there was also some change in the grain, the nutritive ratio was made much wider. . . .

"There was a fairly normal decrease in the milk yield. There was an increase in the per cent and in the amount of fat."

In 1893, 3 trials were made with alfalfa. The first trial was with 10 cows and lasted from May 17 to July 15, 4 periods, the grain being changed the second period to a ration containing somewhat less nitrogen. The second trial during July was with 9 cows, and the same grain ration was used as in the last part of the preceding trial. The third trial was with the same 9 cows, and lasted from August 17 to

September 15. In this trial a different grain ration was used. The summary of the results follows:

Comparisons of alfalfa fodder with other green fodders on cows in 1893.

	Food per day.		Yield per day of—		Fat content of milk.	Dry matter eaten per pound of—		Cost of food per pound of milk.
	Total digestible nutrients.	Nutritive ratio.	Milk.	Total solids.		Milk.	Total solids.	
	Pounds.		*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds.*	*Cent.*
Corn silage	10.01	1:7.1	24.53	3.49	4.47	0.76	5.60	0.62
Alfalfa and rye fodder[1]	12.64	1:6.5	23.05	3.18	4.39	.86	6.25	.60
Alfalfa fodder	13.16	1:5.7	22.53	3.16	4.42	.95	6.75	.64
Oat-and-pea fodder	12.77	1:5.4	22.69	3.12	4.28	.86	6.25	.68
Oat-and-pea fodder	12.95	1:5.4	25.64	3.56	4.26	.77	5.54	.62
Alfalfa fodder	15.37	1:5.6	23.02	3.16	4.20	1.02	7.41	.65
Clover hay and oat-and-pea fodder	13.98	1:5.8	21.57	3.08	4.65	1.06	7.43	84
Alfalfa fodder and corn silage	16.92	1:7.0	23.30	3.32	4.49	1.10	7.71	·71

[1] Grain ration changed.

"[In changing from the first to the second period] there was about a normal decrease in milk yield. The cost of milk and of fat was about the same for both periods. The nutritive ratio was made somewhat narrower when rye fodder was discontinued and more alfalfa fed. There was considerable increase in the amount of protein. There was a slight decrease in the milk yield, probably less than the normal. The milk and its fat cost somewhat more. In changing from alfalfa to oat-and-pea fodder more fodder and grain were fed; the amount of digestible protein remained about the same, but there was a little falling off in the total nutrients. The cost of the ration was somewhat greater, also the cost of the milk and fat, although there was no falling off in milk yield.

"In changing from oat-and-pea fodder to alfalfa fodder in the second trial there was somewhat more than the normal falling off in the milk yield. The milk and the fat cost a little more for the second period than for the first. . . .

"[Comparing the two rations in the last trial] there was considerable increase in the average milk yield for the second period and the milk and fat cost less, although there was a slight decrease in average per cent of fat in the milk."

The results of 2 trials in 1894, the first with 9 cows and lasting during May, and the second with 8 cows, lasting during June and July, are summarized below:

Comparisons of alfalfa fodder with corn silage and with oat-and-pea fodder on cows for 1894.

	Food per day.		Yield per day of—		Fat content of milk.	Dry matter eaten per pound of—		Cost of food per pound of milk.
	Total digestible nutrients.	Nutritive ratio.	Milk.	Total solids.		Milk.	Total solids.	
	Pounds.		*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds.*	*Cent.*
Hay and corn silage	12.53	1:7.4	22.51	3.10	4.25	0.96	6.94	0.72
Corn silage and alfalfa fodder.	12.41	1:5.4	24.81	3.25	4.47	.82	6.29	.61
Alfalfa fodder	13.42	1:4.1	22.44	3.18	4.45	.99	6.96	.66
Alfalfa fodder	15.17	1:6.4	27.82	3.69	3.88	.89	6.61	.54
Oat-and-pea fodder	18.68	1:6.9	25.38	3.35	3.77	1.09	8.29	.56

"[In the comparison of alfalfa and oat-and-pea fodder] the ration for the second period had a little wider nutritive ratio than that for the first. There was an increase in the amount of each digestible constituent and an increase of the fuel value. The cost of the ration was somewhat less. There was a decrease in milk yield at about the normal rate; the percentage of fat was, however, slightly lower. There was a slight increase in the cost of milk and more in the cost of fat. The average gain in weight per cow for June was 11.6 lbs, and for July 2 lbs."

The results of several other trials made during 1894 are reported, but as the grain was changed in these as well as the green fodder, rendering it difficult to tell how much of the result was due to the change of green fodder, the data are omitted here.

In conclusion, some general observations are given on the results of these numerous trials of feeding alfalfa to milch cows, and a comparison is given of the average composition of alfalfa fodder and of corn fodder.

"When alfalfa fodder was substituted for some other food or the amount of alfalfa in the ration increased, there followed in 10 instances a decrease in the cost of the milk, in 2 instances a very slight increase in cost, and in 2 instances the cost of milk was practically the same. There was an increase in the yield of milk in 7 instances, a decrease in 4 instances of about what might normally be expected to occur without change of food, and little change in yield in 3 instances.

"When the change was from a ration containing alfalfa to one containing less or no alfalfa, there followed an increase in the cost of milk in 10 instances and there was about the same cost once. There was a decrease of the milk yield in 9 instances, and an increase of the milk yield in 2.

"When alfalfa was substituted for other foods in the ration or the amount of alfalfa increased there followed a decrease in the cost of fat in 7 instances and an increase of the cost in 6 instances. There was an increase of the amount of fat in 6 instances, a decrease in 5 instances, and little change in amount twice.

"When the change was from a ration containing alfalfa to one containing less or none, there followed an increase in the cost of fat in 9 instances, a decrease in cost once, and there was about the same cost twice. There was an increase of the amount of fat in 3 instances, a decrease in 3, and about the same amount of fat in 5.

"When the change in the ration was to more alfalfa, or to alfalfa in place of some other food, there followed a decrease in per cent of fat in milk in 6 instances, an increase in 3, and little change in per cent in 4 instances. When changed from a ration containing alfalfa to one containing less or none, there followed an increase in per cent of fat in 6 instances and a decrease of per cent in 5.

"There has been usually an increase in milk yield accompanying the use of alfalfa, although there was often at the same time a decrease in the per cent of fat. With alfalfa fodder rated at the same cost as other fodder there was generally a decrease in the cost of milk when the alfalfa was fed, and not much change in the cost of the fat produced.

"Corn fodder (fully matured) in the results accompanying its use has compared most favorably with alfalfa; but except in the form of silage it is only available for a short time in the fall before frost. Alfalfa is ready for the first cutting about the time for planting corn and about as early as rye fodder can be cut. The proportions of constituents also differ so widely between alfalfa and corn fodder that these plants can not well be considered as substitutes for each other but as supplementary. For making rations like those usually fed, coarse fodder and grain foods, in general cheaper than those used with corn fodder, can be fed with alfalfa. The more highly nitrogenous grains and hays fed with corn fodder or silage, however, have a much higher manurial value, which fact is often of wide importance.

"The palatability of alfalfa or of corn (maize) is greater than of most other forage plants of rapid growth that will yield heavy crops. This is a matter of the greatest importance, for while the milk may temporarily be produced at the expense of loss in weight of the animal, the flow of milk must be sustained by the food taken in excess of that necessary for maintenance.

"Any discussion of the general fluctuations of milk yield as influenced by the proportions of the different constituents of the food, and by the nutritive ratio of the ration, is reserved until some data from winter rations fed for longer periods shall be published."

Pasture vs. pasture and grain for milch cows, J. H. SHEPPERD (*North Dakota Sta. Bul. 16, pp. 68-72*).—Two lots of 2 cows each were fed grain *vs.* no grain with pasturage in alternating periods of 2 weeks. The pasturage was composed of mixed tame grasses and clover and was of good quality. The grain appears to have been bran and shorts. The yield and composition of the milk are tabulated and a financial statement given.

"There was an increase in the yield of butter fat and a small gain in flesh when grain was fed. The gain in butter fat comes from an increased yield of milk, as no increase in the percentage of fat, of any account, is shown."

The financial statement shows a profit of $7.69 from feeding the grain.

Pig feeding, H. T. FRENCH (*Oregon Sta. Bul. 35, pp. 49-56, pls. 3*).—A litter of 8 pigs, seven-eighths Berkshire, was fed together during the summer largely on green vetch with a grain ration. "Pigs are very fond of the vetch. They would very often leave their grain for the vetch." After the supply of vetch was exhausted they received shorts and water.

October 1 the pigs were divided into two equal lots for the fattening period, which lasted until January 18, when they were slaughtered. At the beginning of this period the pigs ranged from 95 to 159 lbs. in weight. Lot 1 was fed cracked wheat which was soaked in water from one feed to the next, and lot 2 was fed a mixture of 2 parts of cracked wheat, 1 part of shorts, and 1 part of cracked oats by weight up to January 4, when the oats were discontinued. The data as to food consumed and gain in weight are tabulated for each pig in periods of 4 weeks. The average results for each lot are shown in the following table:

Cracked wheat vs. grain mixture for pigs.

	Average daily gain in weight	Total food consumed.	Food consumed per pound of gain.	Cost of food per pound of gain.[1]
	Pounds.	*Pounds.*	*Pounds.*	*Cents.*
Lot 1, cracked wheat	1.46	3,052	4.72	3.07
Lot 2, grain mixture	1.70	3,210	4.28	2.80

[1]Cracked wheat 65 cts., oats 60 cts., and shorts 60 cts. per 100 lbs.

At the time the pigs were slaughtered they ranged in weight from 281 to 357 lbs. The data obtained at slaughtering are tabulated and plates are given showing the whole and sections of the carcasses.

"Lot 2 gained 752 lbs., or an average daily gain of 1.7 lbs. each. Lot 1 gained 646 lbs., or an average daily gain of 1.46 lbs. The pigs fed on the mixture ate 156 lbs. more of grain than those fed on chopped wheat alone. The shorts fed to lot 2 was a little cheaper than chopped wheat, hence the cost of producing a pound of pork was a little less in this lot than in lot 1.

"A bushel of chopped wheat, 60 lbs., produced 12.9 lbs. of gain in lot 1. At 4 cts. per pound gross weight for the pork it would give a return of 51.6 cts. per bushel for the wheat. In lot 2 there was a gain of 14 lbs. for every 60 lbs. of grain consumed. . . .

"If the pigs could have been slaughtered 4 weeks earlier the results would have been a little more favorable. . . .

"The pigs of lot 2 were more uniform in size. This was partially true at the beginning, there being one in the lot a few pounds lighter than the others. The pigs fed on wheat alone were much more sluggish in their habits. They did not move about with as much ease as the other lot.

"In table showing weight of organs there is a striking difference in the weight of the livers of the two lots. Lot 2 ranged from 5 lbs. to 7 lbs. 4 oz., while in lot 1 the range is from 3 lbs. 4 oz., to 4 lbs. 4 oz. The kidneys of pig No. 1 in lot 2 were abnormally large, weighing 10 oz. They were not healthy, slight watery tumors being found on them. There was more inside fat in lot 2 than in lot 1. Of the intestines there was a greater weight in lot 1 than in lot 2. . . . The shrinkage [in dressing] was nearly the same in each lot."

On the composition of some French and foreign oats, BALLAND (*Jour. Agr. Prat., 59 (1895), No. 11, pp. 386-388*).—The general results of food analyses of oats from different countries are stated.

On the comparative digestibility of sugar, fodder, and distillery beets, P. GAY (*Ann. Agron., 21 (1895), No. 4, pp. 145-171, figs. 2*).

The systematic use of potatoes as food for animals, A. GIRARD (*Compt. Rend., 120 (1895), No. 18, pp. 969-974*).

Food plants of the North American Indians, V. HAVARD (*Torrey Bul., 22 (1895), No. 3, pp. 98-123*).

The frozen meat trade as conducted in the Colonies and Great Britain, II, A. BRUCE (*Agl. Gaz. N. S. W., 6 (1895), No. 2, pp. 65-113*).—This report deals with best breeds of sheep for export, the export meat trade of Australia, preparation of meat for export, cold storage, deceptions practiced in the frozen meat trade, and distribution of frozen meat in England.

The utilization of sugar-beet molasses, M. HOLLRUNG (*Fühling's landw. Ztg., 44 (1895), No. 9, pp. 285-292*).—With special reference to its value as a food for domestic animals.

Rations fed on 27 farms, BOLSTER (*Deut. landw. Presse, 22 (1895), No. 38, pp. 357, 358*).—The means of improving certain faulty rations are pointed out.

Feeding experiments with peanut meal and malt sprouts, SCHLECHTER (*Tirol. landw. Blätter, 14 (1895), No. 9, pp. 81, 82*).

Causes of the color of brown bread, L. BOUTROUX (*Compt. Rend., 120 (1895), No. 17, pp. 934-937*).

On the changes in making brown bread, J. CHAPPUIS (*Compt. Rend., 120 (1895), No. 17, pp. 933, 934*).

Food colors and food preservatives, H. LEFFMANN (*Dietetic and Hyg. Gaz., 1894, October; separate, pp. 11*).

Conservation of meat, WACKER (*Chem. Ztg., 19 (1895), No. 39, p. 913, fig. 1*).

Means of supplying the deficiency of straw and forage (*Ann. Sci. Agron., 6 (1895), II, No. 2, pp. 280-296*).

Peanut oil with sour milk as a food for calves, M. PETERSEN (*Ill. landw. Ztg., 1894, No. 96; abs. in Milch Ztg., 24 (1895), No. 5, p. 76*).

A feeding experiment with rape cake on milch cows, VON LIEBENBERG (*Mitt. Ver. Förd. landw. Versuchw. Oesterr., 1894, II, No. 9, pp. 133-140*).

Feeding experiments with sorghum bagasse for milch cows, H. WEIGMANN (*Landw. Wochenbl. Schles.-Holst., 45 (1895), No. 10, pp. 150-154*).

Effect of oat straw and vetches on milk production (*Fuhling's landw. Ztg., 44 (1895), No. 9, p. 295*).—A brief note in which the author favors the feeding of oat straw, but disapproves of the free use of vetch seed for milch cows.

Dairy herd record, 1894, J. H. SHEPPERD (*North Dakota Sta. Bul. 16, pp. 65-68*).—A brief record is given for 1894 of the station herd of 16 ordinary cows (grades and natives), together with a financial statement showing a profit from butter making of $237.74 for the herd. The average yield of butter per cow during the year was 220 lbs. The best record was from a grade Jersey, making 337 lbs. of butter, and the poorest from a "scrub," yielding 143 lbs. of butter.

Potatoes as a food for cattle and sheep, A. GIRARD (*Jour. Agr. Prat., 59 (1895), No. 20, pp. 709-712*).—Recent experiments by the author indicate a high feeding value for potatoes, especially when cooked.

Value of rape for sheep, J. A. CRAIG (*Breeders' Gaz., 1895, May 22, pp. 324, 325 figs. 2*).—Reference is made to favorable results with rape in Canada, Michigan, and Wisconsin.

Cattle and buffaloes of Assam, H. Z. DARRAH (*The Agl. Ledger, 1894, No. 14, pp. 13*).—A popular article noting qualities, uses, care, and diseases of these animals in Assam, Calcutta, 1894.

The polled breeds of cattle, J. L. THOMPSON (*Agl. Gaz. N. S. W., 6 (1895), No. 2, pp. 114-131, pls. 4*).—The breeds discussed are Polled Aberdeen or Angus, Galloway, Norfolk, and Suffolk.

Cattle breeding in Belgium and the means of encouraging it, T. VERNIEUWE and T. VAN AUTGAERDEN (*Bul. Min. Agr. Belgique, 10 (1895), No. 4 and 5, pp. 443-475*).

Heredity in domestic animals, D. S. JORDAN (*Abs. in Up-to-Date Dairying, 4 (1895), No. 2, pp. 179-184*).

VETERINARY SCIENCE AND PRACTICE.

Big head, A. W. BITTING (*Florida Sta. Bul. 26, pp. 53-63, figs. 11*).—Big head or big shoulder (*Osteo-porosis*) was found among horses in a number of localities in the State. The author considers the evidence of the contagiousness of this disease inconclusive, and he found but little difference as to the susceptibility of native and imported stock. The cause is regarded as unknown.

"One of the first symptoms noticeable is the dropping of the croup. . . . Following this is weakness of the back and enlargement of the bones of the face or lower jaw or of the shoulder. . . . The ribs gradually change so that a round-barreled horse becomes flatsided, with a tendency to hang heavy below. The back becomes straight, and the younger the animal the greater the tendency to become elevated or arched. . . .

"A peculiar lameness precedes or accompanies all the processes. The lameness comes on very suddenly, at first very difficult to locate, appearing at one time to be in one joint, and found in another when an examination is made. . . .

"The lameness ceases as quickly as it comes. The animal assumes a very peculiar gait. There is little shoulder movement, the steps are short, executed as if there

was stiffness in all the joints; the hind legs are carried farther under the body than natural, thus giving the appearance of kidney trouble."

An animal once affected is said never to recover. However, the author states that the greatest improvement in the animal's condition may be effected by affording rest, and by the administration of lime in the drinking water, or by giving daily one or two tablespoonfuls of dicalcic phosphate of lime with the food.

Leeches or leeching, A. W. BITTING (*Florida Sta. Bul. 25, pp. 37–48, figs. 4*).—Other synonyms for this disease, which attacks horses, mules, and cattle, are bursatte and round-celled sarcoma.

"Leeches is a non-contagious, malignant disease, characterized by an external sore, in which there are tissue changes involving the epithelium, connective tissue, muscles, tendons, bones, or glands, associated with the development of bodies known as leeches. The disease is slow in its progress, and has a tendency to recurrence during hot, damp weather."

In Florida the disease is widely distributed, but is most prevalent on low lands and usually occurs during the warmest months.

"The disease begins with a slight local swelling, heat and pain, a thickening of the skin and the tissues immediately beneath. The thickened portion gradually decreases from the center outward, but leaves a well-defined base. This outline may not be perceptible to the eye, but can be distinguished by the sense of touch. The whole is movable, and the skin may not be attached to the indurated part, or to but a small portion of it. In from 2 to 10 days small spots like the pointing of an abscess may be seen. The hair falls out, and drops of yellowish, watery fluid exude. Across these points the skin will break, and a malignant sore is formed. The tissues are broken down, and all unite to form one open surface, which never extends beyond the indurated base. The edges of the skin turn back, leaving a decided mark between what seems to be the diseased tissue and what seems to be healthy. Such a division does not actually take place. Within the thickened tissue are formed the small bodies, called the leech. At first they are very small, but begin to enlarge, and attain the size of a pea, of a grain of corn, and even become half an inch in diameter. They are readily separated from the fibrous tissue and resemble a sandspur (bur of *Cenchrus tribuloides*)."

The legs below the knees, the fetlocks, heels, feet, lips, breast, and belly suffer most. The nature and cause of this disease are not understood. Microscopic examinations of tissue were made and a number of cases were treated. Medicinal treatment was usually ineffectual and excision, or removal of the diseased tissue, is regarded as the most satisfactory method of treatment.

Lameness in horses and mules, T. BUTLER (*Mississippi Sta. Bul. 31, pp. 41–54*).—The topics treated are the following: General indications of lameness; causes, symptoms, and treatment of foot puncture, foot evil, founder (laminitis), ringbone, splint, bone spavin, stifle (luxation of the patella), and strains. The main points of treatment recommended for these various troubles are as follows: For foot puncture, making an opening for the escape of foul matter and the use of a 4 per cent solution of carbolic acid; for foot evil, the application at first of strong liquid carbolic acid, and subsequently of a 4 per cent solution of car-

bolic acid; for founder, the local use of water or of a poultice of wheat bran or flaxseed meal; for ringbone and splint, blistering with 1 part red oxid of mercury to 4 parts of lard (and firing); for bone spavin, blistering; for stifle, blistering, returning the patella to its proper position and preventing for a time the leg from being extended backward; and for strains, the application of 1 part of the fluid extract of belladonna in 7 parts of dilute alcohol.

An outbreak of bovine rabies, J. B. PAIGE (*Massachusetts Hatch Sta. Bul. 27, pp. 23-38, map 1*).—In Ware, Massachusetts, 20 head of cattle on 5 farms died with a disease that was diagnosed as rabies. The history of the outbreak is recorded and the disease traced to a mad dog. The symptoms are fully described. Among the most important of these were a state of intense uneasiness and excitement, grating of the teeth with champing of the jaws, frequent fits of bellowing, and continued straining. The temperature remained normal and the alterations of the pulse were slight. Death resulted in from 1 to 7 days after the first signs of illness. Nine of the animals averaged 24⅜ days between the time that they were bitten and the first indications of illness. In 2 other animals the period of incubation was 47 and 68 days.

Tuberculosis and tuberculin at the Massachusetts Agricultural College, J. B. PAIGE (*Massachusetts Hatch Sta. Bul. 27, pp. 3-23*).—A description of the station barn, a history of the herd, and a report of tuberculin tests are given. Of 32 animals slaughtered in June, 1894, only 7 were free from tuberculosis, while only 2 were badly affected. With 3 animals which on *post mortem* examination were found to be apparently sound, an injection of tuberculin produced a marked rise in temperature. In one case where the autopsy revealed the presence of tuberculosis, the injection of tuberculin was not followed by a well defined reaction. The temperatures of the animals tested are tabulated. It was found impracticable to disinfect a barn which had become thoroughly infected with the germs of tuberculosis, and in such a barn the complete eradication of the disease is regarded by the author as well nigh impossible.

Poisoning of cattle with nitrate of soda, J. B. PAIGE (*Massachusetts Hatch Sta. Bul. 27, pp. 39-42*).—In a herd of 15 cows 11 died as a result of eating nitrate of soda, given by mistake with the feed, instead of common salt. Of the animals that showed signs of sickness only 3 recovered. Among the symptoms were paralysis of the posterior parts of the body, purgation, and dark and swollen anus and vulva. The condition of the heart and lungs of the animals submitted to *post-mortem* examination indicated death from asphyxia.

Reference is made to similar cases in which nitrate of soda had poisoned horses and cattle. In one case a horse was relieved by the administration of strong infusions of coffee and alcohol and irritant clysters.

Scab, lumpy jaw, and anthrax, D. A. CORMACK (*South Dakota Sta. Rpt. 1893, pp. 95-105*).—A reprint of Bulletin 36 of the station (E. S. R., 5, p. 203).

Parturient apoplexy, J. A. GILRUTH (*New Zealand Dept. Agr., Leaflets for Farmers No. 12, pp. 2*).—A popular article giving symptoms and treatment.

Ergotism in cattle, J. R. CHARLTON (*New Zealand Dept. Agr., Leaflets for Farmers No. 11, pp. 2*).—A popular discussion of the cause, symptoms, and treatment of this disease.

Detection of tuberculosis bacilli, E. SENFT (*Pharm. Post, 1895, No. 28, p. 177; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., p. 132*).

Rupture in cows (*Deut. landw. Presse, 22 (1895), No. 34, p. 321, figs. 4*).—Methods of bandaging are shown.

A contribution to the study of swine plague, hog cholera, and pneumo-enteritis of swine, W. SILBERSCHMIDT (*Ann. Inst. Pasteur, 9 (1895), No. 2, pp. 65–103*).

A contribution to the study of venoms, toxins, and antitoxic serums, A. CALMETTE (*Ann. Inst. Pasteur, 9 (1895), No. 4, pp. 225–251*).

Concerning a variety of Bacterium chauvœi, G. P. PIANA and B. GALLI-VALERIO (*Ann. Inst. Pasteur, 9 (1895), No. 4, pp. 258–264, figs. 5*).

DAIRYING.

Creamery practice—Babcock test vs. "space system," J. B. LINDSEY (*Massachusetts Bd. Agr. Dairy Bureau Bul., pp. 29, pls. 2, fig. 1*).—The object of this study was to compare the results of paying for cream at cream-gathering creameries by the space and by the amount of fat in the cream. The writer accompanied the cream gatherers of a large creamery, taking samples from 165 patrons together with the spaces of cream furnished. These samples were tested for fat by the Babcock test. The results for 50 patrons are tabulated. The fat in the cream was found to range from 11 to 22 per cent. "Three patrons furnished cream between 11 and 13 per cent butter fat, 8 patrons between 13 and 15 per cent, 36 patrons between 15 and 17 per cent, 73 patrons between 17 and 19 per cent, and 45 patrons between 19 and 22 per cent." The following summary shows the pounds of butter fat furnished per 100 spaces of cream by different patrons and the comparative value of the same:

Amount and value of butter fat per 100 spaces of cream.

Amount of butter fat per 100 spaces.	Aggregate number of patrons	Per cent of patrons.	Approximate amount of fresh butter per 100 spaces.	Approximate value of fresh butter at 25 cts. per pound.
Pounds.			*Pounds.*	
8 to 11	4	2	11 00	$2.75
11 to 12	9	6	13 50	3 37
12 to 13	24	15	14 50	3 62
13 to 14	50	30	15 50	3 87
14 to 15	41	25	17 00	4.25
15 to 16	28	17	18 00	4 50
16 to 17	7	4	19 25	4.81
17 to 18	2	1	20.50	5.13

"One observes that 15 per cent of the patrons furnish 100 spaces of cream that will make $3.62 worth of butter at 25 cts. per pound; 30 per cent furnish cream equivalent to $3.87 worth of butter; 25 per cent furnish cream having a butter value of $4.25, while 17 per cent give $4.50 worth of butter for 100 spaces of cream."

The calculated difference between the amount paid for the cream by the space and by the Babcock test in 30 days amounted in a number of cases to an increase where the Babcock test was used of from $5 to over $12, and in some other cases to a loss of as much as $23.

The weight of cream per space was determined in 36 cases, and this varied from 0.622 to 0.971 lb. and averaged 0.75 lb.

To determine the amount of butter made from cream from different patrons 3 different lots were used, one containing 12 per cent of fat, another 20.4 per cent, and a third 17 per cent. Butter was made from this cream and the amounts of fat in the butter and in the buttermilk determined. Samples of the butter were also analyzed. The results follow:

Butter produced from different kinds of cream.

	Spaces of cream taken.	Fat in cream.		Butter produced.		Total fat in butter and buttermilk.
		Per cent.	Amount.	Amount.	Fat.	
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Sample 1	17	12.0	1.68	[1] 2.50	1.536	1.67
Sample 2	25	20.4	3.57	4.50	3.440	3.49
Sample 3	25	17.0	3.32	4.25	3.200	3.23

[1] Fresh—to 2.58 lbs. salted.

According to the butter-makers' report the number of spaces of cream required to make a pound of butter was 6.41 for sample 1, 5.55 for sample 2, and 5.88 for sample 3; but sample 1 contained nearly 35 per cent of water. Reducing the butter to a uniform fat content there was required 8.76 spaces of sample 1, 5.55 of sample 2, and 6.19 of sample 3.

"These results simply emphasize the fact that the number of spaces of cream required to make a pound of butter depends entirely upon the amount of butter fat in the cream; and if comparisons are made, the quality of the butter, so far as its water and fat content are concerned, must by no means be lost sight of. The value of cream for butter, other things being equal, is governed entirely by the amount of butter fat it contains. . . .

"The Babcock test proved perfectly reliable in our case. The weight of butter fat in the butter and buttermilk agreed practically with the weight of butter fat in the cream churned."

The bulletin concludes with an illustrated description of the Babcock test and directions for applying it in the payment for cream in cream-gathering creameries.

Cream ripening with pure cultures and pasteurizing, G. BÄHNCKE (*Milch Ztg.*, *24* (*1895*), *Nos. 8*, *pp. 119*, *120*; *9*, *pp. 134*, *135*).—A discussion of the use of pure cultures and pasteurizing in butter making. The author has had practical experience with the use of pure cultures, and is convinced that they mark a progress in butter making, provided the cultures are obtained from a reputable establishment. Instead of making butter making a more complicated and difficult operation he contends that they simplify it, since their use makes it possible to prescribe

exact rules for the work, and insures a product of more uniform quality. His method of transplanting the pure culture as it comes from the laboratory is as follows: Ten liters of skim milk is heated for 2 hours at 80° C. (176° F.) by placing the vessel containing it in a larger vessel of water into which steam is conducted. It is then cooled to 32° C. and the bottle containing the pure culture is emptied into it, the mixture being thoroughly stirred until there are no lumps. This reduces the temperature 1 or 2 degrees, and this temperature is maintained. After about 18 hours the mixture becomes thick and is thoroughly cooled without stirring, which should be absolutely avoided after the culture is added. This serves as the basal supply from which a starter is made every day.

In transplanting the acid from day to day a quantity of skim milk sufficient to sour the cream the next day is heated at 80° C. for 2 hours, then cooled to about 28°, and 10 per cent of the transplanted pure culture added, and kept at this temperature for 6 to 8 hours, when it is thick. It is then cooled without stirring and kept on ice until used. Before using, the top is dipped off, and the remainder well stirred. This is repeated every day. The author earnestly recommends that a new starter be prepared every day, and not to use the buttermilk, since action of undesirable bacteria is best prevented in this way. The more carefully the basal supply of the culture is prepared and kept the longer it can be used. It lasts usually from a week to a month, though if care is exercised it can be used for several months and has in some cases been kept for a year and a half.

Skim milk is recommended for making the starter, and never whole milk or cream, as the fat in the latter is said to obscure any bad taste which may develop.

The following is the proportion of starter recommended for adding to the cream: In pasteurized cream, 5 to 6 per cent or more; unpasteurized cream on farms, 4 per cent or more; and at creameries, 5 per cent or more.

Compared with the advantages of using pure cultures the author considers the extra labor and expense of the cultures to be of no account. He uses the cultures put up by Blauenfeldt & Tvede in Copenhagen. The butter made with the aid of these cultures received the highest prizes at recent shows.

The second part of the paper is taken up with a discussion of pasteurizing cream, based largely on results obtained in Denmark. The author concludes that the advantages of pure cultures are greater and more certain with pasteurizing.

Whey butter, H. H. WING (*New York Cornell Sta. Bul. 85, pp. 37–41*).—An account is given of 21 trials in the manufacture of butter from whey during January and February. In these separate trials from 1,222 to 3,001 lbs. of whey was used, which ranged in fat from 0.21 to 0.33 and averaged 0.25 per cent. The cream was raised by a

separator. In order to secure a sufficiently thick cream it was found necessary to separate twice. In the first separation about one-tenth of the bulk of the whey was taken as cream, containing from 2 to 5 per cent of fat, and this "first cream" was run through the separator a second time. With the Danish-Weston separator this second separation was not necessary, as, owing to the construction of the machine, cream of good consistency could be raised in one operation. The whey was run through the separator immediately after it was drawn and before it had cooled down, although no difficulty was experienced as far as flavor of the butter was concerned from holding the whey 24 or even 48 hours before separating. It is recommended to separate the whey at once, and where possible to churn the cream preferably within 24 hours.

"The cream from the whey, containing as it does, very little casein, was very easily, quickly, and completely churned at a low temperature. The most complete churning was obtained when the churn was started at a temperature from 48 to 54° F., the time required in most cases being less than 20 minutes."

On the average, 2.57 lbs. of butter was made from each 1,000 lbs. of whey, and as the whey averaged 0.25 per cent of fat, nearly all of the fat in the whey was recovered.

The quality of the whey butter is pronounced good, being scarcely, if any, inferior to that made from whole milk. Good judges were either unable to detect any difference between whey butter and butter from milk, or only slight inferiority in the texture and flavor.

Whether or not whey butter can be profitably made is not discussed in the bulletin, although the additional expense incurred is pointed out. As to the amount of fat which might be saved in this way it is estimated that the whey produced in New York State annually contains 4,342,362 lbs. of fat, which would make 4,776,598 lbs. of butter, worth, at 20 cts. per pound, $995,319, or about 50 cts. for each cow in the State.

A milking machine (*Southern Planter, 56 (1895), No. 5, p. 234*).—This article is taken from the *Farmer and Stock Breeder*, of England, and describes several successful trials with the Thistle milking machine, invented by Shields and Elliot.

"The principle of this machine is a vacuum, caused by the complete exhaustion of the air from a storage tank, and the connecting tubes all round the byre. The exhaustion is caused by an air pump, which can be driven by a belt from a steam, gas, or oil engine, or horse power; 1½ or 2 horsepower is enough to milk 20 cows. One man driving an air pump can milk 4 cows at a time. The most interesting and intricate part of the whole machine is the cups, and the similarity of their action to the hand milking, or to the sucking of the calf. The pulsation of the cup on the teat is caused by the vacuum vibrating from 5 lbs. to 15 lbs.; when at 15 lbs. the cup closes on the teat; at 5 lbs. it relaxes. The pulsation must be regulated to about 45 strokes per minute."

In the trials the machine milked a number of heifers with very small teats, and did it so thoroughly that when they were afterwards stripped

by hand less than 2 gills of milk was obtained from the lot. A herd of Ayrshires with very large teats was milked dry with the machine. "The size of the teats made no difference; . . . there was nothing left." The machine had been in regular use at one farm for 1 year and at another for 6 months. It is said that it is being placed in several dairies in England.

The physiology and mineral material of milk, C. PAGES (*Rev. Sci., ser. 4, 3 (1895), No. 18, pp. 559–561, figs. 4*).

On the bacteriology of St. Petersburg milk, M. P. SACHAREKOW (*Wratsch, 1895, No. 16, p. 325; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., p. 131*).

On the excretion of bacteria through the milk glands, and on the germicidal properties of milk, F. BASENAU (*Arch. Hyg., 23, No. 1, pp. 44–86*).

Concerning butyric acid fermentation, E. BAIER (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 1, pp. 17–22; 2, pp. 84–87; 3, pp. 118–120*).

Sterilized milk, DUCLAUX (*Ann. Inst. Pasteur, 9 (1895), No. 4, pp. 281–288*).—A critical review with special reference to the value of sterilized milk for infants.

The preparation of milk for children, I, BACKHAUS (*Deut. landw. Presse, 22 (1895), No. 41, p. 386*).—A popular article enumerating the advantages of sterilization.

Milk for children, A. STUTZER (*Die Milch als Kindernahrung. Bonn: 1895*).

Cream ripening with bacillus No. 41, H. W. CONN (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 11, pp. 385–391*).

Estimation of acidity in milk, M. SCHAFFER (*Staz. Sper. Agr. Ital., 26 (1894), pp. 161–167; abs. in Jour. Chem. Soc. London, 67–68 (1895), p. 94*).

On the unreliability of the creamometer for determining fat in pasteurized milk, P. CAZENEUVE and E. HADDON (*Jour. Pharm. et Chim., ser. 6, 1895, No. 1, p. 393; abs. in Chem. Ztg., 19 (1895), No. 38, Repert., p. 128; and Rev. Internat. Falsif., 8 (1895), No. 9, pp. 152, 153*).

How can good skim-milk cheese be made from centrifugal skim milk? J. SAMEK (*Tirol. landw. Blätter, 14 (1895), No. 10, pp. 90–92*).

The detection of milk adulteration and its nature, and the calculation of the amount of water added or the extent of skimming, R. KRUEGER (*Molk. Ztg., 9 (1895), Nos. 6, pp. 73, 74; 7, pp. 89, 90*).

Milk inspection and milk standards, H. LEFFMANN (*Med. News, 1895, Feb. 2; separate, pp. 9*).—The author discusses at some length the danger of the transmission of disease through milk, and contends that the sanitary control of milk supply is a matter of far more importance than the control of the chemical composition, with which the present milk inspection usually stops.

Butter making, E. E. KAUFMAN (*North Dakota Sta. Bul. 16, pp. 74–80*).—Popular remarks on cream raising, churning, washing, salting, working, and packing butter, together with notes upon dairying.

On the composition of cheese-factory washings, A. BÖMER (*Ztschr. angew. Chem., 1895, No. 7, pp. 194, 195*).

The dairy industry in Denmark, Schleswig-Holstein, and Holland, F. DELEN and S. TANGHE (*Bul. Min. Agr. Belgique, 10 (1895), No. 4 and 5, pp. 315–431, figs. 34*).—This report treats of the management of cattle, coöperative creameries, sale of milk, pasteurization, manufacture of butter and cheese, dairy apparatus, and dairy schools.

TECHNOLOGY.

Concerning the appearance of bacteria in the products of sugar manufacturing, A. STIFT (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 7 and 8, pp. 227–283*).

Estimation of starch in compressed yeast, F. FILSINGER (*Chem. Ztg., 18 (1894), p. 742; abs. in Jour. Chem. Soc. London, 67–68 (1895), p. 93*).

Estimation of crystallizable sugar in raw sugars, M. KAREZ (*Chem. Centbl., 17 (1894), pp. 845, 846; Ztschr. Zuckerind., 23, pp. 21–24*).

Gravimetric estimation of glucose, F. GAND (*Compt. Rend., 119 (1894), pp. 478, 479; abs. in Jour. Chem. Soc. London, 67–68 (1895), p. 92*).

Gravimetric estimation of sugar by means of alkaline copper solution, L. GRÜNHUT (*Chem. Ztg., 18 (1894), pp. 447, 448; abs. in Jour. Chem. Soc. London, 67–68 (1895), pp. 91, 92*).

Muscovado sugar making in Antigua during 1894, F. WATTS (*Sup. Agl. Jour. Leeward Islands, 1895, Jan. 17*).—This article is devoted to manufacturing processes.

The origin of wine lees, A. JÖRGENSEN (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 9 and 10, pp. 321–329*).

On judging the quality of barley for brewing, C. KRAUS (*Deut. landw. Presse, 22 (1895), No. 34, pp. 320, 321*).

Studies of the amorphous nitrogenous organic compounds of beer worts, H. SCHJERNING (*Ztschr. analyt. Chem., 34 (1895), No. 2, pp. 135–147*).

A contribution to the knowledge of gall formation with reference to tanning products, M. KÜSTENMACHER (*Pringsheim's Jahrb. wiss. Bot., 26 (1895), No. 1, pp. 82–185, pls. 6; abs. in Bot. Centbl., 62 (1895), No. 6, pp. 182–184*).

Caoutchouc, A. DEWÈVRE (*Rev. Ques. Sci. Brussels, 7 (1895). April, pp. 560–583*).—The plants producing this product, its physical and chemical properties, purification, and statistics of production.

AGRICULTURAL ENGINEERING.

A new method of irrigation, F. W. RANE (*Rural New Yorker, 1885, June 1, p. 375, figs. 2*).—Tiles laid end to end on the surface of the soil between rows of celery secured successful and economical irrigation.

Electricity as a motive power for the farm, F. BRUTSCHKE (*Deut. landw. Presse, 22 (1895), Nos. 28, p. 262; 29, pp. 273, 274*).

Improvements in haying machinery (*Amer. Agr. (middle ed.), 1895, May 18, p. 549, figs. 10*).—Some improvements in mowing machines, rakes, and hay carriers are described and figured.

A Russian grain-drying kiln (*Deut. landw. Presse, 22 (1895), No. 38, p. 355, figs. 2*).

A device for ventilating stables, P. KICK (*Deut. landw. Presse, 22 (1895), No. 33, p. 315, figs. 2*).

STATISTICS.

Report on the agricultural experiment stations and agricultural colleges of the United States of America, P. G. CRAIGIE (*British Bd. of Agr., 1895, pp. 80*).—This is a report to the president of the Board of Agriculture on the experiment station movement of this country, description of visits to a number of the colleges and stations, lists of the bulletins recently published by the different stations, an account of the college and station exhibit at the World's Fair, and statistics in regard to the stations and colleges. "Great and practical energy is obviously being directed to the discovery of the best means of extending the field of agricultural and horticultural knowledge."

Annual Report of Illinois Station for 1894 (*Illinois Sta. Rpt. 1894, pp. 14*).—Brief general remarks on the work and publications of the year, a list of experiments in progress, and a detailed financial statement for the fiscal year ending June 30, 1894.

Annual Report of Maryland Station for 1894 (*Maryland Sta. Rpt. 1894, pp. 178–194*).—Brief general remarks on the work of the year by the director and heads of departments, and a financial statement for the fiscal year ending June 30, 1894.

Annual Report of Oklahoma Station for 1894 (*Oklahoma Sta. Rpt. 1894, pp. 7*).—A list of the bulletins published, brief general remarks on the conduct of the station, and a financial report for the fiscal year ending June 30, 1894.

Annual Report of South Dakota Station for 1893 (*South Dakota Sta. Rpt. 1893, pp. 120*).—Brief reports on the work of the year by the director and heads of departments, the treasurer's report for the fiscal year ending June 30, 1893, and reprints of Bulletins 32 to 36.

A manual of instruction for crop correspondents, H. A. ROBINSON (*U. S. Dept. Agr., Division of Statistics, pp. 28*).—This publication consists of explanations of the methods used by statistical correspondents in securing data on which are based the reports of the Division.

Report of the Statistician for April, 1895 (*U. S. Dept. Agr., Division of Statistics Rept. 125, n. ser., pp. 107–168*).—The subjects treated are as follows: Condition of winter grain; farm animals; number of families occupying farms owned, free, and unincumbered; amount of incumbrance on farms; health of the people; production, imports, and exports of potatoes; production and prices of wool in Italy; potatoes and hay in Great Britain in 1894; cotton crop of India for the year 1894–95; rice crop of India for the year 1894; report of European agent; and transportation charges.

MISCELLANEOUS.

Progress in the physical sciences during 1893 (*Die Fortschritte der Physik im Jahre 1893, vol. 49, No. 1: Physik der Materie. Braunschweig: 1895, pp. LXX, 562*).—An effort is now being made by the Berlin Physical Society to issue this excellent review of the literature of physics in all its branches more promptly than heretofore. The 3 volumes for the year 1888 have just recently appeared; as much of the value of such a publication depends upon the promptness with which it is made accessible to the investigator, it has been a source of regret that these useful reviews should have fallen so far behind. Hereafter the society will issue each year the volumes containing the current literature, and in addition complete one year of the gap between 1888 and 1893 until all are published.—O. L. FASSIG.

Agriculture of the United States, H. MOOS (*Rpt. Switz. Delegates to World's Exposition at Chicago, 1893, pp. 180*).

Socialism and agriculture in France, D. ZOLLA (*Ann. Agron., 21 (1894), No. 3, pp. 97–122*).

On the present relations of agricultural art and natural science, R. WARINGTON (*London: H. Frowde, 1895*).

A comparison of excelsior waste and straw as litter, P. DE VUYST (*Cultures Spéciales, Borsbeke-lez-Alost, 1894, pp. 61–63*).—The first appeared to be more effective as an absorbent than the latter, and the manure produced with it gave slightly better returns on beets and potatoes.

NOTES.

PURDUE UNIVERSITY AND STATION.—C. S. Plumb, who has heretofore acted as director of the station and assumed charge of the administrative affairs in the School of Agriculture of the University, has been relieved of the latter by the board of trustees, that he may devote more attention to the work of the station. The administrative work of the school of agriculture has been transferred to Prof. W. C. Latta, professor of agriculture in the university.

MISSOURI UNIVERSITY AND STATION.—H. J. Waters, of Pennsylvania State College, has been elected dean of the College of Agriculture and Mechanic Arts and director of the station, and will take his seat in September.

NEBRASKA STATION.—By reason of long and severe illness C. L. Ingersoll has resigned as director of the station.

NEW YORK STATE STATION.—At a meeting of the board of control held June 7, Dr. Collier, director of the station, was given a vacation of three months on account of long-continued ill health. Dr. L. L. Van Slyke, the station chemist, was made acting director for this period. The last legislature voted $7,500 with which to erect on the station property three new residences for members of the station staff; also $1,000 with which to erect a building for the exhibition and storage of fruit.

NORTH DAKOTA COLLEGE AND STATION.—J. H. Worst has been elected president of the college and director of the station to succeed J. B. Power.

PENNSYLVANIA COLLEGE.—The legislature of 1895 appropriated $212,262.23 to the college for the two fiscal years beginning June 1, 1895. Of this sum, $10,000 is "for the maintenance of the Department of Agriculture, including the creameryman's course, dairy course, and winter lecture course."

WASHINGTON STATION.—The Washington State Agricultural College and School of Science will organize an adjunct experiment station at Puyallup July 1, and F. A. Huntley, of Colorado Station, has been elected its superintendent.

PERSONAL MENTION.—Dr. A. N. Berlese has become professor of botany in Libera Universita at Camerino.

Dr. F. von Tavel has been placed in charge of the botanic museum of the Polytechnicum at Zurich.

Dr. S. Nawaschin has been chosen professor and director of the Botanic Gardens at Kiew.

Dr. L. von Meyer, professor of chemistry in Tübingen University, died April 12, 1895, aged 65 years.

Dr. Dangeard has been chosen professor of botany of the Faculty of Sciences of Poitiers.

Among the candidates recently recommended by the Council of the Royal Society for election into the society is John Eliot, meteorological reporter to the Government of India. Mr. Eliot, as meteorological reporter to Bengal, and in his present position has done much for Indian meteorology and the improvement of the administration of the meteorological system of India. Among the official publications issued under the direction of Mr. Eliot, the daily weather maps of the monsoon area are of especial interest. They cover a large area and extend through a period of two years, affording a splendid opportunity for a systematic study of monsoon phenomena.

EXPERIMENT STATION RECORD.

VOL. VII. No. 2.

The present number of the Record contains the concluding chapter of an article by Dr. J. B. Lindsey, of the Massachusetts Station, on the organization, equipment, and work of the experiment station at Darmstadt, Germany, which gives the details of Wagner's method of pot experimentation.[1] The Darmstadt Station is justly considered a model as regards equipment for this kind of investigation. The methods there pursued are the result of years of continuous effort to perfect a system of exact research into the laws of plant nutrition. The development of this system was prompted by a conviction on the part of Professor Wagner that it is impossible to secure results that can be relied on from field experiments on either large or small plats of soil under natural conditions, even when the greatest precautions are taken.

It may not be generally admitted "that the results of such [field] experiments are in no way to be depended on when looked at in the light of scientific research," but there is a growing skepticism among thoughtful investigators in this country as to the reliability of the plat method. Although at first thought comparatively simple, the method is beset with difficulties which experience has shown to be extremely hard to overcome. Frequently the results of a year's work are vitiated by conditions entirely beyond the control of the experimenter. It is only by a thorough appreciation of the difficulties to be guarded against, a strict attention to all details, and a continuation of the experiments through a series of years that the experimenter can hope to secure results of scientific value.

By means of pot culture many of the sources of error in plat experiments are eliminated. The conditions are made more uniform and are to a larger extent brought under the control of the experimenter. For instance, the soil is made uniform in both chemical and physical properties, and may be exhausted of any single fertilizing ingredient if desired; the supply of plant nutrients is measured more definitely; the supply of water is made the same for all the pots; the ravages of insects are very largely prevented; and the factor of meteorological conditions is eliminated. In this way definite laws are worked out with greater certainty

[1] The methods of conducting pot experiments at the Bernburg Experiment Station, where the assimilation of atmospheric nitrogen has been extensively studied, have already been described (E. S. R., 5, pp. 749, 835).

and in less time than would be possible by plat experiments. As a matter of fact practically all that is at present known concerning the fertilizing ingredients required by plants has been demonstrated by pot and water cultures. To this may be added our knowledge of the assimilation of atmospheric nitrogen by plants, the nitrification of soils, and the availability of many different forms of plant food. The best combinations of fertilizing ingredients for different crops have in many cases been suggested by the results of pot experiments, and this method is being very largely employed in Europe in studying the whole question of plant nutrition.

There are many questions which field experiments in their most improved form are adapted to studying, such as certain general questions relating to the mutual adaptability of soil, climate, and plant; methods of culture; relative value of different crops and of varieties; rotations, etc. They are also useful in demonstrating the practical value of the principles deduced by more exact methods and thus popularizing the results of agricultural investigation. Many of the American stations enjoy exceptionally favorable conditions for field experiments in that it is possible for them in many cases to carry on parallel experiments on virgin soil and on the same soil modified by different systems of culture and manuring. We can not afford to discard the system of field experiments as a means of investigation, but we should not lose sight of its inherent weaknesses, and should endeavor to so systematize and improve it that these sources of error will be reduced to a minimum.

Pot experiments afford a valuable means not only for supplementing but for controlling field experiments. As already suggested, field experiments may serve the purpose of demonstrating the practical value of the results of more exact methods, but pot experiments may be equally useful as a check on field experiments. Experiments in pots are also almost indispensable in those cases where a great variety of typical soils are to be studied at the same time with reference to physical and chemical properties.

The value of the method of pot experimentation as an adjunct to other means of investigation is being more widely recognized in this country every year. Some of our stations are now well equipped for work in this line, and it is believed that the results obtained by them will fully justify further extension of the system.

WAGNER METHOD OF POT CULTURE.

J. B. LINDSEY, PH. D.

In the previous paper[1] the objections to field experiments were discussed and brief mention was made of the method worked out by Prof. Paul Wagner at the Darmstadt Experiment Station for studying problems in plant nutrition in cylinders sunk into the ground and in movable pots. The following are the principles on which this method rests:

PRINCIPLES UNDERLYING THE METHOD.

(1) All conditions having any influence upon the development of the plant must be similar for each similar experiment.

As conditions might be mentioned physical and chemical character of soil, the amount of plant food and water present, compactness of the soil, distribution of fertilizer, quantity of seed, depth of planting, number of individual plants, thickness of planting, light, heat, circulation of air, etc.

(2) The limit of error must be ascertained by carrying out parallel experiments, and each experiment must be continued until accurate average results are obtained.

This is extremely important, and in by far the larger number of experiments heretofore made it has been entirely lost sight of. In order to illustrate this Wagner gives the following example:

Suppose a field 1 hectare in area be used for the purpose of studying the comparative values of phosphoric acid in the form of dissolved boneblack and Thomas slag. The common method of experiment would be to divide the field as nearly as possible into three equal parts, applying 30 kg. of boneblack phosphoric acid to one plat and an equal quantity of phosphoric acid from Thomas slag to another, leaving the third plat free from phosphatic manure. Each of the three divisions would be manured with nitrogen and potash in excess. If the field were planted with wheat, the excess of the yield of the phosphoric acid plats over the one not thus treated would be taken to show the relative effects of the two forms of phosphoric acid.

It would, however, be by no means right to draw such a conclusion, for in so doing it is assumed that each of the three plats had exactly the same conditions of soil and moisture, were injured to the same

[1] E. S. R., 7, p. 3.

extent by birds or insects, and were manured, planted, and harvested in exactly the same manner. Now, it is hardly possible to have all of these conditions precisely the same. In such an experiment it is quite probable that the error caused by one or the other varying condition would have been so large as to more than overbalance the increase in yield caused by the phosphoric acid applied, and hence the results would be false.

The correct way would be to divide the field not into three, but into twelve equal plats, leaving four without any phosphoric acid and applying the two different forms to the other eight, one form for each four. With the results of four plats in case of each separate test it is possible to note the uncontrollable limit of error, and if not too great variations exist the average of the four plats in each case should give safe figures from which to draw conclusions.

An average of parallel experiments should be taken as a basis from which to draw conclusions only when these experiments are made upon the same soil and under precisely similar conditions.

(3) In conducting experiments the pots or plats containing the fertilizer to be tested should be made to produce the highest possible yields over those not fertilized. In this way the accuracy of the method is increased.

For example, if the error in case of parallel experiments were but 2 per cent it would as a rule be considered very small. If, now, the average of the unmanured plats should be 100 lbs. of grain, and the average of the manured plats 105 lbs., the error of 2 per cent or 2 lbs. would be altogether too large to admit of conclusions as to the effect of the fertilizer being shown. On the other hand, if the plats were so treated that the unmanured produced 100 lbs. and the manured 150 lbs. the error of 2 per cent would be of no practical account.

(4) It is important to select a soil which is as poor as possible in the ingredient to be tested.

If different forms of phosphoric acid are to be studied and a soil is selected so rich in that ingredient that without an application a certain area will produce 400 lbs. of grain, and a like area after a liberal application will show an increase of but 50 lbs. over the unfertilized, such increase is certainly far too small to allow any trustworthy conclusions to be drawn.

Sand would be very poor in all three ingredients, but the physical condition of sand is not suitable for such an experiment. The most suitable soil by far is the surface soil of cultivated fields poor in the ingredient to be studied. If soils can not be procured that are one-sidedly exhausted they must be prepared. The method of preparation will be described further on.

(5) In order to prove the value of any particular element of plant food those plants should be selected that have the greatest need of this ingredient.

(6) There should be no excess of the fertilizing ingredient tested left in the soil.

If 30 lbs. of soluble phosphoric acid from boneblack produces 200 lbs. of wheat, and 30 lbs. of phosphoric acid from Thomas slag produces a like quantity, one is by no means justified in saying that the Thomas slag gives equally as good results as the dissolved boneblack. It is quite possible that all of the 30 lbs. of soluble phosphoric acid was not necessary to produce that amount of wheat; perhaps 15 lbs. would have produced as large a yield.

In order to prevent an excess in the soil of the ingredient to be tested, it is of the first importance that the other necessary elements of fertility be present in liberal quantities. Only when this condition is fulfilled is it allowable to draw conclusions. It is by no means an easy problem to secure these conditions, for it is equally important that these ingredients be not present to such an extent as to prove injurious to plant growth. Wagner states the case as follows: These other ingredients are to be applied (*a*) in proportion to the quantity of the fertilizing ingredient being tested; (*b*) according to the amount which the soil has at its disposal; (*c*) in proportion to the absorptive power of the soil; (*d*) according to the particular need of the plant for these several ingredients; (*e*) depending upon the sensitiveness of the plants toward an excess of the ingredients, and (*f*) according to the quantity of plant growth produced on a given area.

A knowledge of the soil and of the plants to be used as well as some experience is necessary in order to supply the excess ingredients in the correct quantities to secure such a favorable development of the plant that the extra amount produced over the unmanured pots is to be attributed to no other cause except the influence of the ingredients being tested.

(7) Different quantities of the ingredient to be tested should be used, and conclusions should be drawn only when the increase in the yield keeps pace with the increase in the quantity of the ingredient applied.

If, for example, 1, 2, 3, 4, and 5 gm. of nitrogen produces 100, 200, 300, 400, and 420 gm. increase in yield, respectively, it is clear that the first 4 yields kept pace with the increased supply of nitrogen, while the fifth application of nitrogen did not for some reason have opportunity to do its full work. The first 4 applications make it evident by reason of the regular increase that no other ingredient was lacking and that the condition as called for above was fulfilled.

One can therefore depend on the results from the 1, 2, 3, and 4 gm. applications but not on those from the 5 gm. application.

(8) The experiment must be conducted in such a way as to clearly show that the increase in yield was brought about by the single ingredient under investigation, and not by any other influence.

If it is desired to prove the value of the phosphoric acid in ground bone the fact must not be lost sight of that the bone contains nitrogen

as well as phosphoric acid. Now it is not possible to remove this nitrogen, and yet it is important that when the phosphoric acid in the bone is tested the nitrogen it contains should in no way affect the results. Therefore, if the soil does not contain an excess of nitrogen such an excess should be applied, together with sufficient potash to enable the bone phosphoric acid to be turned to full account. In this way if any increase in yield results it can be attributed to the phosphoric acid alone.

DETAILS OF THE WAGNER METHOD.

A description was given in the preceding article[1] of the general arrangements of the greenhouses and experimental gardens. As there stated there are two greenhouses, with doors opening outward and tracks running out into the garden. On these tracks the movable pots are transported in wagons, being moved out in pleasant weather and returned to the greenhouses at night or when a storm is threatened. A more detailed description of the pots, tracks, and wagons is here given, followed by the details of the method.

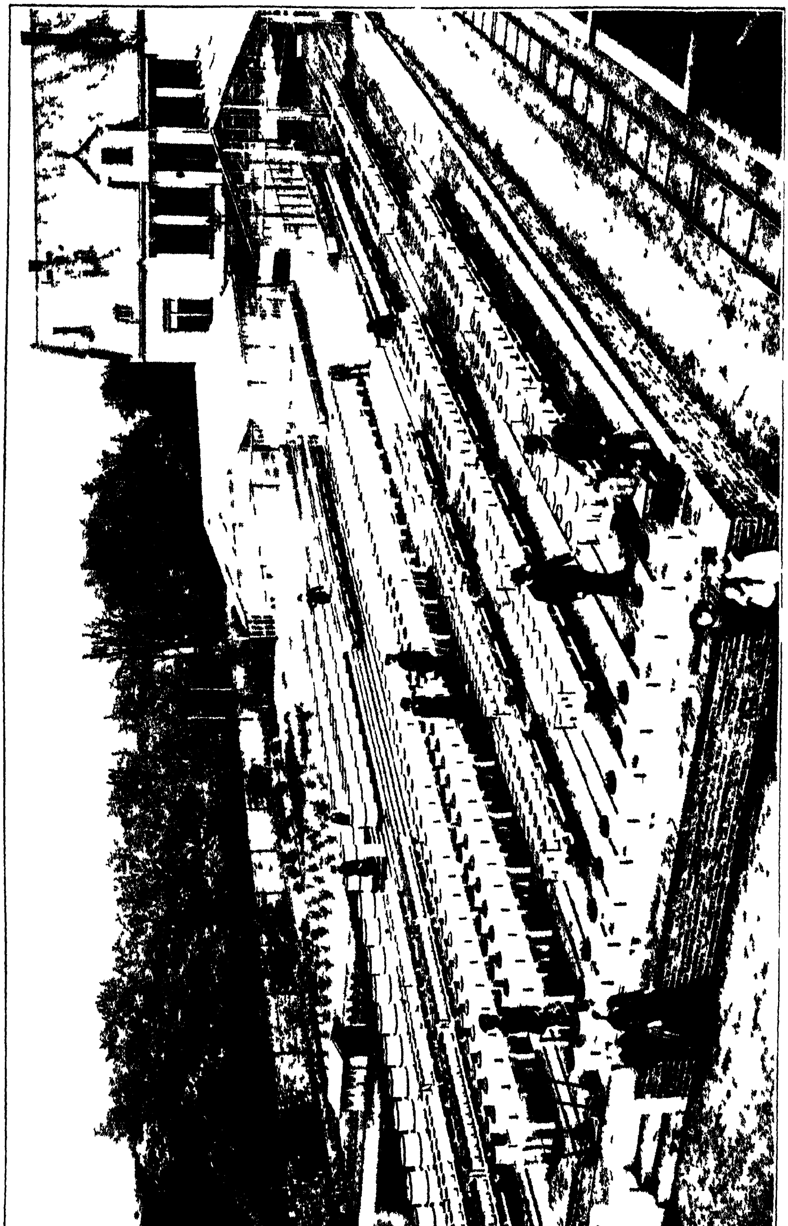
POTS.

The pots as well as the large soil cylinders are made of zinc. The interior was formerly coated with asphaltum, but this was afterwards found to be unnecessary, the zinc having no injurious effect upon the plant.

The movable pots are so arranged that part of the water can be supplied from beneath. To attain this end several devices were formerly in use, but the one now preferred consists of a zinc tube about three-fourths inch in diameter securely fastened to the outside of the pot, extending from the middle to the base where it opens into the bottom. A piece of sheet zinc rolled over into a semi cylindrical form, with notches cut out on the under edges, connects with the tube opening and extends across the bottom of the pot. This arrangement prevents the water tube from getting clogged by the gravel and soil and allows the water to enter freely. An iron rim extends around the top of the pot to strengthen it, and just below the rim at equal intervals three sockets are securely soldered, into which the cage or frame fits, which is to support the plant. The pots rest upon iron legs fastened on to the outside, thus raising them about 2½ in. above the surface on which they rest. Each pot must be water-tight. The cylinders which are inserted in the ground are also made of zinc, and have no bottoms. An iron rim about the top gives them stability.

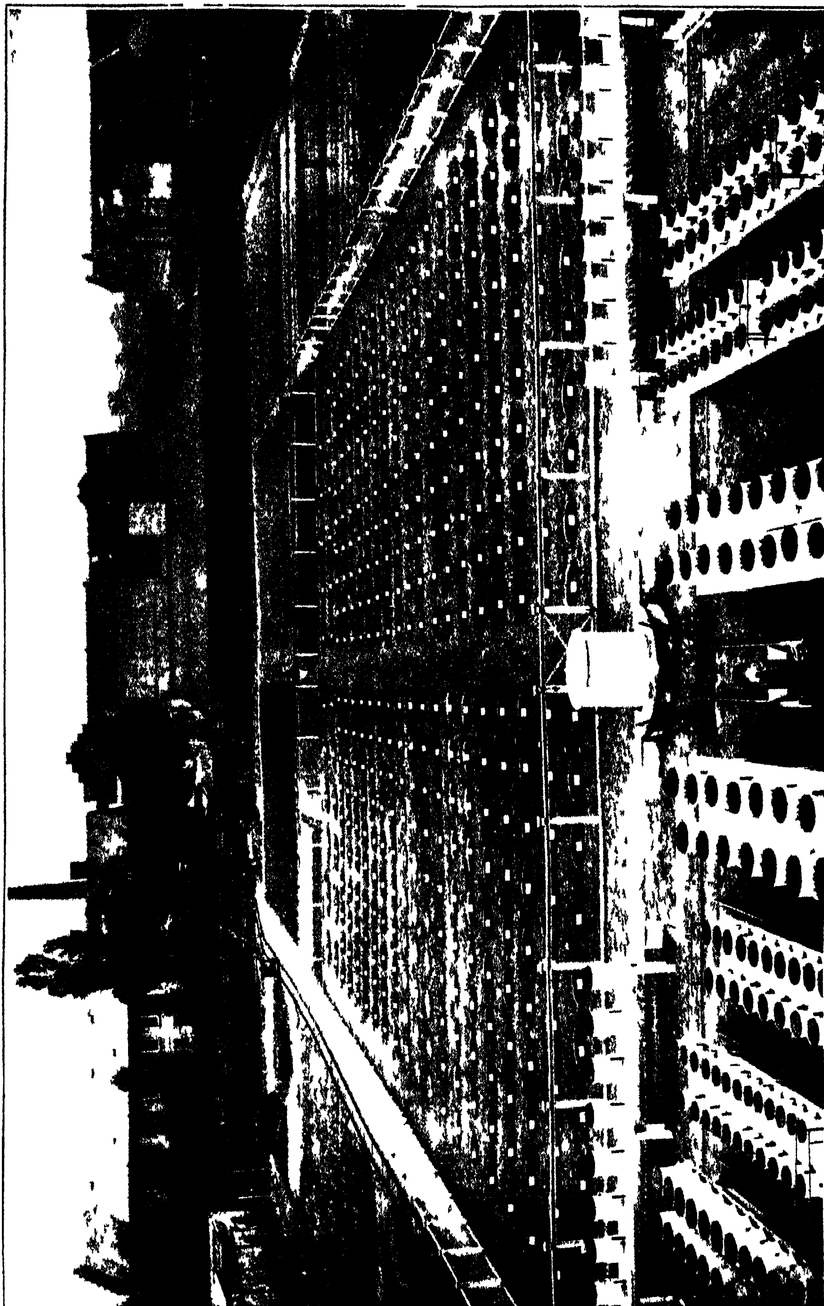
The Darmstadt Station has in use the following cylinders and pots: 24 embedded cylinders 100 cm. in diameter and 133 cm. deep; 360 cylinders 60 cm. in diameter and 133 cm. deep; 51 pots supported on rails, 60 cm. in diameter and 80 cm. deep; 50 pots supported on legs, 30 cm. in diameter and 33 cm. deep; 316 pots supported on legs, 25 cm. in diam-

[1] E. S. R., 7, p. 4.



UPPER GARDEN

PLATE



LOWER GARDEN

eter and 33 cm. deep; 408 pots supported on legs, 20 cm. in diameter and 20 cm. deep, and 100 pots supported on legs, 17 cm. in diameter and 20 cm. deep. The latter, because of their small surface area, are not to be recommended.

WAGONS AND RAILS.

The wagons were formerly constructed of wood, but are now made entirely of iron. They are each $10\frac{3}{4}$ ft. long and 2.1 ft. wide, the platform being 15.5 in. from the ground. The wagons have no sideboards. The wheels, 6 in number, run upon iron rails.

The rails are made of steel and are, of course, much smaller than those used by railroads, being especially made for such light purposes. The distance between the rails is $19\frac{1}{2}$ in.

PREPARATION OF THE SOIL

Attention has already been called to the fact that soils should be selected that are as poor as possible in the ingredient to be tested. It is, however, hardly possible to procure a soil that has been one-sidedly exhausted, and it therefore becomes necessary to prepare one. At the Darmstadt Station several pits have been constructed, and filled with various soils to be prepared for special uses. These pits are 2 ft. deep and have a surface area of some 36 sq. yd. They are surrounded and separated one from another by brick walls, the tops of which are about on a level with the surface of the ground. A soil to be exhausted of its potash, for instance, is filled into one of the pits, fertilized liberally with nitrogen and phosphoric acid, and planted, for example, with potatoes or beets, for several years, until practically no crop can be grown. The soil to be exhausted of phosphoric acid is fertilized with nitrogen and potash, and the one to be made nitrogen poor is manured with potash and phosphoric acid, and the several soils planted with those crops which make special demands upon the ingredient to be removed. By such a method it is very easy to obtain a soil well adapted for special purposes without in any way disturbing its physical character. The soil thus prepared is sufficient for a very large number of experiments, covering a series of years. In case of field experiments, on the other hand, a plat that it had required years to prepare could be used only for a single experiment.

Before the soil is ready for use it should be removed from the pit, brought into the covered shed, and thoroughly mixed by repeated shoveling. It should also be screened by passing it through a suitable sieve to remove any stones or refuse and to secure a uniform degree of fineness.

SPECIAL USES OF THE POTS AND CYLINDERS.

The pot method has been criticised because it is claimed that the soil in the pots standing in the open would have a noticeably higher temperature than the soil in the field, and as a consequence the conditions would not be favorable for a normal development. While it is true

that the temperature of the soil in the pots would be somewhat higher, it has been shown that such a condition exerts no serious influence upon the final result. In order, however, to control the results obtained with pots, in many cases the same experiments are conducted in the embedded cylinders.

In cases where it is important that no plant food be carried down below the reach of the roots and lost, the closed pots alone are to be depended on. For example, in testing the absolute amount of nitrogen that can be obtained by different plants from nitrate of soda and dried blood it is very important that all of the nitrogen be retained within reach of the plant roots. In testing the comparative availability of the phosphoric acid in bulky fertilizers, such as stable manure and ground bone, the cylinders would naturally be used. The cylinders would also be preferred in studying problems in green manuring and in many cases in working with large plants, such as Indian corn, potatoes, etc.

PLANNING THE EXPERIMENTS.

Before beginning to fill the pots the plan of the different experiments should be carefully mapped out, and each distinct experiment designated as a series. Each single test should be made in triplicate to guard against error, and the average of the three yields taken as the true result. In case any one of the three single pots shows a wide variation from the other two the result is eliminated from the average. Each pot is numbered distinctly and the amount of the different fertilizers it is to receive, together with the kind and quantity of seed, is noted upon a record sheet especially prepared for the purpose. If the fertilizer is to be applied in several portions during the season the fact is noted. The various fertilizers are all carefully tested in the laboratory to determine their exact strength. With this record sheet before him, the chemist weighs out the different fertilizers into small, numbered glass tumblers shortly before the pots are to be filled.

FILLING THE POTS.

About 2 to 2½ cm. of good quartz gravel, about the size of a small pea, should be placed at the bottom of the pot. Each pot should contain the same quantity of earth, and it is therefore necessary to weigh the amount before putting it in. A pair of platform scales on a truck which runs on the rails serves for this purpose. The small pots (20 by 20 cm.) hold 8 kg. of soil, and those 25 by 33 cm. hold 20 kg., etc. The fertilizer should be thoroughly mixed with the soil to a depth of 20 to 25 cm. In case of the small pots the fertilizer can be mixed with the entire 8 kg. of soil. The pots as a rule should be filled in the glass houses to prevent the loss of any fertilizer that might possibly be carried away by the wind. The soil, having been previously thoroughly mixed and screened, is placed in a pail or hod of light sheet iron large enough to hold several pecks of earth and the whole balanced upon the plat-

form scales. The quantity of earth to be added to each pot is then weighed out and, if no fertilizer is to be added, emptied, a portion at a time, into the pot, and packed down. Care must be taken that it is not pressed too firmly and on the other hand it must be sufficiently compressed so that a pot of 25 cm. in diameter and 33 cm. deep will hold the necessary 20 kg. of earth. The lot of soil to which the fertilizer is to be added is placed upon the platform of the wagon, over which an oil cloth has been spread. The fertilizer is sprinkled over the earth and the glass which contained the fertilizer rinsed out with a little soil. The soil and fertilizer are then thoroughly mixed, emptied into the pot, and gently pressed down.

SELECTING THE SEED AND TIME OF PLANTING.

Well-developed, guaranteed seed should be selected. They should be spread out in a thin layer and all those of an inferior appearance rejected. The seeds should not be soaked in water before planting.

The object of the experiment will of course govern the time when the seed should be planted. As a rule the seed is sown at the same time as in general farm practice.

QUANTITY OF SEED.

The rules of practical experience are allowed to govern the quantity of seed to be sown. Since every seed will not germinate and some of the young plants are liable to be injured by insects, it is advisable to sow maximum quantities. Several days after the young plants appear all inferior ones are removed. By this means the right number of average plants to each pot is secured. It is not of so much importance whether the seed be planted thick or thin. The plants from a comparatively thin seeding are better developed than those from a thick seeding. The amount of dry matter produced in each case would be about the same. A single example will make this clear. In one case at the Darmstadt Station ½ gm. of oats was sown per pot, and in another case 1 gm. The following were the results:

Crop from thick and thin seeding of oats.

One gram per pot.		One half gram per pot.	
Straw.	Grain.	Straw.	Grain.
Grams.	*Grams.*	*Grams.*	*Grams.*
24.1	13.5	24.6	12.9
25.3	12.8	25.6	12.8
25.1	11.9	25.4	13.7
24.1	14.5	24.7	14.3
24.7	13.2	25.1	13.4

PLANTING THE SEED.

In order to have each seed at the same depth the soil is very carefully leveled with a suitable wooden instrument, and the seed placed upon it at regular intervals and gently pressed into the soil. If necessary the

seed can be covered with a certain amount of soil. This latter should be a portion of the 8 or 20 kg. intended for each pot. When the pot is properly filled the earth should be about a centimeter below the rim.

FILLING THE CYLINDERS.

The same principles are observed in filling the embedded cylinders as in the case of the movable pots. The subsoil selected is first added in weighed quantities and tamped down. The surface soil to the depth of 1 ft. is then added in separate portions and also pressed down. The soil containing the fertilizer should have a depth of 25 cm., the same as in the movable pots. In order to mix the fertilizer with the soil a large cloth is spread upon the ground, the soil put upon it, the fertilizer spread over the soil, and both carefully mixed, and then shoveled into the cylinder. In case stable manure is used it is first forked over several times, then run through a medium sized hay cutter, mixed again, and finally mixed with the soil. Each cylinder should contain the same quantity, and when the filling is completed the earth should be about an inch below the rim of the cylinder. The method for selecting and planting the seed has already been described. In case of large seeds such as potatoes the method of planting followed by farmers should be adhered to.

WATERING.

It is important that the water in the pots should not be allowed to evaporate to such an extent as to cause the plants to wilt, and on the other hand such an excess of water should not be supplied as to interfere with plant growth. The distribution of water in the soil should not be lost sight of. When water is supplied to a very dry soil, it must be sufficient in quantity to equally moisten the entire soil mass. When some parts of the soil are drier than others and the moisture in the dry portions is still further removed by the plant roots, regular growth is interfered with, and variations occur in the amount of dry matter produced by the different pots.

Every pot is weighed several times daily and the amount of water evaporated returned, part through the tube and part poured upon the surface. Pots 20 by 20 cm. receive from ½ to 1 liter, and pots 25 by 33 cm., 2 to 3 liters of water daily. The quantity of water to be supplied depends upon the absorptive power of the soil and upon the weather conditions. In very warm weather water can be added until it is observed to stand in the side tube; it will disappear in a very few hours. When the weather is cool and the atmosphere moist, on the other hand, such an excess would be used very much slower and would be liable to interfere with the regular growth of the plant.

In taking the daily weights of the pots the periodic variations in the weight of the plant growth in the different pots should not be lost sight of. Whenever possible the weight of the plant is approximated. In case this can not be done with sufficient accuracy the following method

is adopted: The weight of the pot and the soil at the time of filling being known, together with the moisture percentage of the soil, and knowing to what percentage the amount of soil moisture can be reduced before the plant wilts, one has only to take the weight of the pot in question when the plant actually begins to wilt in order to calculate the weight of the plant mass.

The embedded cylinders depend upon nature for their supply. Only in periods of drought are they watered artificially and then the same quantity should be supplied to each cylinder.

INFLUENCE OF WIND AND SHADE.

It is important that the plants be kept out of the shade, and that they be protected so far as possible from the wind; also that the plants of one series do not shade or prevent the proper circulation of air about another. If shade can not be prevented during a part of the day it is very important that plants in the same series be treated alike as regards sunlight. As different amounts of fertilizers will produce different growths, those plants that are more fully developed will naturally cast more shade than those of lesser growth; it therefore becomes necessary to place the pots far enough apart and also to change them about from time to time in order to secure for all the pots as nearly as possible the same amount of sunlight and air.

Different plants during the growing season will need more or less support. Wire supports of various shapes have been used for this purpose. These are generally held in place by pushing the ends of the frame into the soil, or into little sockets fastened to the outside of the pots. The wire cage answers well for supporting legumes and such plants. Other plants can be supported by fastening them to long sticks pushed into the soil.

PROTECTION FROM BIRDS.

To prevent injury from birds after the seed has been planted, and until the plants are well up, in case of the embedded cylinders coarse netting is stretched across the entire garden; the small pots are protected by being kept in the glass houses. For protection at the time when the seeds are maturing someone is kept in the garden from sunrise until sunset. The covering of the pots and cylinders with frames and netting has proved very inconvenient and not altogether successful and has been given up.

During the entire growing season it is important that the plants be closely watched. The pots should be run into the glass houses every night. Someone should be on hand at all times during the day to guard against sudden rain or wind storms. A heavy storm of rain or wind might destroy the entire work of a season.

The cylinders, being miniature field plats, are of course subjected to all kinds of weather. A high fence built about the experiment garden serves to protect the plants from the full force of heavy winds.

HARVESTING.

It is hardly necessary to state that the harvesting should be carefully done. The plants are cut off close to the soil. A cloth spread upon the ground will prevent the loss of any seed that might fall. When it is not convenient to make dry matter determinations at once, such plants as the grains and legumes which are quite dry when harvested are put in large paper bags, properly marked, and hung up until wanted. Plants which are succulent when cut must first be partially dried, either in the sun or by artificial heat, otherwise they will be injured by mold. The material must also be protected from mice. When necessary, large wire closets can be constructed, which will serve as a protection and at the same time in no way interfere with the circulation of the air. Tubers, etc., are easily preserved. Whenever necessary dry matter determinations should be made at once, and proper samples preserved for future analysis.

PRESERVING THE PLANT ROOTS.

In the majority of cases in experiments of this kind it is seldom necessary to preserve the plant roots for analysis. Whenever this is desired, however, the entire contents of the pot are placed in a large sieve of fine wire, and by repeated immersions in water the soil washed out from the roots. After the earth has been removed as thoroughly as possible by this treatment, the siliceous material still remaining is estimated by an ash determination and the amount subtracted from the total weight of roots.

ANALYSIS OF THE HARVESTED MATERIAL.

It is necessary in the first place to weigh with exactness the amount of grain and straw or roots and leaves grown in each cylinder or pot. The convenient opportunity having arrived, be it at harvest time or during the winter season, the grain or seed is separated from the straw and the latter cut into small pieces with scissors, or better, with a small cutting machine. The grain and straw are then weighed separately and the results recorded as so much air dry material. A part of the cut straw and the entire amount of the grain harvested from a single pot or cylinder (the grain without being crushed) is used for a dry matter determination. The estimation of dry matter, however, is in the majority of cases not sufficient to prove the value of a certain form of fertilizer. After the above determination, therefore, the material from each of the parallel tests, if they agree, is mixed together, an average sample taken, ground fine, and preserved in glass bottles for further examination.

In order, for example, to get a correct idea of the influence of the different forms of phosphoric acid it is necessary that the amount of phosphoric acid in the harvested material at different stages of growth be estimated. A single example will make this clear. If for 10 parts of

water-soluble phosphoric acid applied 100 parts increase in dry matter results, and for 10 parts of phosphoric acid in Thomas slag 50 parts increase is noted, the conclusion might be drawn that the same amount of soluble phosphoric acid had caused the production of twice as much plant substance as a like amount of phosphoric acid in the Thomas slag. In drawing such a conclusion one assumes that the entire phosphoric acid taken up by the plant had been turned to account in producing plant growth. This might not be the case. An estimation of the phosphoric acid in the plants might show that while the plants fertilized with Thomas slag contained as much total phosphoric acid as those manured with dissolved boneblack, the Thomas slag phosphoric acid was not there during the earlier stages of growth, when phosphoric acid was in greatest demand, but being more slowly soluble was taken up so late that it could not be worked over into plant substance.

Now, it is the object of scientific experiments of this kind to carefully observe such conditions, and in order to do this it becomes necessary not only that the amount of plant substance produced be noted, but also that the absolute quantity of the specific fertilizing ingredient under consideration be determined.

APPARATUS AND METHOD EMPLOYED IN THE ESTIMATION OF DRY MATTER.

In order to make the numerous dry matter determinations in the substances harvested from the pots and cylinders the following apparatus is used:

(1) Open cylinders are constructed out of tin, zinc, or copper 23 cm. long and 6 cm. in diameter. These cylinders decrease in size toward each end, so that they can be closed with rubber stoppers. Near the opening at the lower end is soldered a fine wire gauze, which allows a free circulation of air during the drying and at the same time prevents the material from falling out.

(2) A large copper drying closet or box is made 1 meter long, 45 cm. broad, and 30 cm. deep. Into this copper box are set vertically 40 copper tubes, open at both ends, into which the cylinders above described exactly fit. Copper pipes for conducting steam surround the copper tubes. To prevent a loss of heat, the box is covered with felt.

By the aid of such an arrangement the dry matter determinations are very rapidly made. Seeds are brought directly into these cylinders without being previously crushed or ground, and at the end of 20 hours a constant weight is obtained. The cylinders are then removed from the drying oven, both ends closed with rubber stoppers, and weighed after cooling. Straw and similar material is first put through a small cutting machine. Four hours is sufficient to dry such substances.

After weighing if the substance is to be further examined it is ground fine in an Excelsior mill, and another dry matter determination made by placing a few grams in a drying bottle and heating to constant weight in an ordinary jacketed drying oven.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Simplified method for the estimation of phosphoric acid by means of molybdate solution, J. Hanamann (*Chem. Ztg., 19 (1895), No. 25, pp. 553, 554*).—The author suggests a modification of the molybdate method, by which he has obtained accurate results. The molybdate solution contains 100 gm. of molybdic acid to 1 liter of 10 per cent ammonia and 1.5 liters of nitric acid (sp. gr., 1.246). The yellow precipitate is obtained in the cold, frequently stirring the solution during a half hour. The dried precipitate, previously washed with ammonium nitrate and nitric acid, is brought to a dull glow in a platinum crucible. When a blue black color is obtained the precipitate has a constant composition, containing 4.018 per cent of phosphoric acid. The author has found that the weight of the ignited precipitate varied from 35.2325 gm. to 35.2010 gm., according as its color was orange or a uniform blue black.—J. P. STREET.

Metaphosphoric acid and the analysis of superphosphates, D. Crispo (*Rev. Chim. analyt. appliq., 3 (1895), p. 56; abs. in Chem. Ztg., 19 (1895), No. 28, Repert., p. 101*).—The author finds that in drying the superphosphate over the free flame the orthophosphoric acid undergoes a partial conversion into the meta acid, the extent of change varying from 10 to 90 per cent, according to the temperature. If the citrate method is used only the ortho acid is determined; with the molybdate method the total acid is obtained. Inasmuch as the fertilizing value of the meta acid has not yet been fixed, and as in the author's opinion superphosphate containing meta acid is of minor importance, he holds that both acids should be determined.—J. P. STREET.

Some conditions affecting the accuracy of the determination of potash as potassium platinichlorid, A. L. Winton (*Jour. Amer. Chem. Soc., 17 (1895), No. 6, pp. 453–466*).—The author states that the accuracy of the method of determining potash by precipitating the concentrated solution with platinic chlorid and drying the double salt at 130° C. depends on the compensation of three errors, due (1) to the solubility of the double salt in 80 per cent alcohol, (2) to the presence

of water in the crystals which is not driven off at 130°, and (3) to the use of a factor based on the wrong atomic weight of platinum.

"The solubility in alcohol occasions an error that can hardly be avoided. It could be diminished by using 95 per cent alcohol, but further experiments would be necessary to ascertain if this were best.

"[The author's results show that] the error occasioned by the presence of water can be greatly reduced and the process of drying simplified by adding the platinum solution to a dilute solution of the potash salt (1 part of potassium chlorid, or six-tenths part potassium oxid to 100 cc. of water) and drying the potassium platinichlorid at 100° C. . . .

"The factors, based on the atomic weights, as revised by F. W. Clarke up to January 1, 1894, would be 0.30688 for potassium chlorid and 0.1939 for potassium oxid."

The kind of dish used, the temperature of the evaporation, the presence of free hydrochloric and sulphuric acids, did not appear to affect the results.—J. P. STREET.

Determination of nitrogen in feeding stuffs by the Kjeldahl method, A. BÖMER (*Chem. Ztg., 19 (1895), No. 9, pp. 166, 167*).—The investigations of the author have shown that in order to get the full percentage of nitrogen in concentrated feeding stuffs, such as cottonseed meal, linseed meal, etc., by the Kjeldahl method, using simply sulphuric acid, it is necessary to continue the digestion longer than is usually done. Other investigators, namely, Gerlach and Süvern,[1] and O. Kellner, O. Böttcher, and G. Diesselhorst[2] have made the same observations. Tests on cotton-seed meal and linseed meal, in which the digestion with sulphuric acid alone was continued for 4, 6, 10, and 16 hours, are reported, showing that the full percentage of nitrogen was obtained only after 10 hours' digestion. Tests on linseed meal, cottonseed meal, peanut meal, and rape cake, in which the feeding stuffs were digested with sulphuric acid containing phosphoric acid, with the addition of mercury, for 4, 6, and 10 hours showed that the full percentage of nitrogen was obtained in from 4 to 6 hours' digestion.

Improved methods of water analysis, I. A. BACHMAN (*Jour. Amer. Chem. Soc., 17 (1895), No. 4, pp. 296–303*).—The author finds by experience with the Wanklyn process, as ordinarily carried out with the usual apparatus, that the losses by imperfect condensation, by the crude way of adding the permanganate solutions, and by the open air contamination of the distillate, render the results very inaccurate. He believes a rate of condensation exceeding 50 cc. in 15 minutes to be accompanied with loss. The proposition of Mallet to keep the original volume of liquid in the retort constant by the addition of ammonia-free distilled water is objectionable because of the difficulty of obtaining a large quantity of water of such purity. He finds that very much better results are obtained by the action of the full strength of the permanganate solution on a smaller and limited quantity of water and supplying the water under examination at about the rate of distillation. He describes the apparatus used and the method of procedure.

[1] Chem. Ztg., 18 (1894), p. 1902 (E. S. R., 6, p. 864).

[2] Ibid., 19 (1895), p. 35 (E. S. R., 6, p. 864).

The Kjeldahl process has been so modified by the author as to secure with the above apparatus gratifying results with the most obstinate organic compounds.—R. H. LOUGHRIDGE.

The composition of maple sap, F. W. MORSE and A. H. WOOD (*New Hampshire Sta. Bul. 25, pp. 4–9*).—Maple trees with many branches and fully exposed to the sun afforded the richest sap; those in a thick grove the poorest. The sucrose in the sap from different trees ranged from 1.30 to 5.60 per cent. "The amount of sugar in the sap has not depended upon variety of maple, since soft maples have yielded both as high percentages of sugar, and as low, as rock maples."

Toward the close of the season the sap was poorer than at the beginning of the season. Analyses revealed neither wide nor constant variation in the composition of the sap from different sides of the tree.

The effect on composition of tapping by means of deep and shallow holes was investigated with inconclusive results.

A drying oven, F. W. MORSE (*New Hampshire Sta. Rpt. 1893, pp. 150, 151, fig. 1*).—This oven, designed for drying substances in hydrogen at the temperature of boiling water, is described as follows:

"It consists of a cylindrical copper box, with double bottom and wall. The inside of the oven is 7 in. in diameter and 9 in. in depth. The space between the walls is 1 in. It is fitted with a water gauge and a steam outlet. This outlet is a screw nipple, and may be coupled to a condenser if desired. The hydrogen enters the oven by means of a brass tube, which is coiled in the space between the bottom and wall and enters the inner oven near the top. The gas is thus thoroughly heated before entering the drying compartment. The gas passes out of the oven near the bottom. . . . The oven is made gastight by a mercury seal. A copper trough is fitted around the top of the oven a little below the rim. The trough is 1¼ in. in depth and ½ in. in width, and is made with brass joints and coated on the inside with lacquer. The cover fits loosely in the trough, and the mercury makes a perfectly tight joint. Drying is hastened by placing an acid dish containing concentrated sulphuric acid on the bottom of the oven. A rack rests upon the acid dish to receive the watch glasses or drying flasks.

In addition to heating the gas the oven is made more efficient by blackening the inner walls to increase radiation, and lining the under side of the cover with a thick sheet of asbestos. The outside of the cover is plated with nickel, which diminishes radiation outward. Repeated trials with a standard thermometer inserted in the oven at the top and between the walls have shown a difference of only two-tenths of a degree between the boiling water and the drying compartment."

Classification of the chemical elements, L. DE BOISBAUDRAU (*Compt. Rend., 120 (1895), No. 20, pp. 1097–1103*).

Argon, Lord RAYLEIGH (*Nature, 52 (1895), No. 1337, pp. 159–164; Science, n. s., 1 (1895), No. 26, pp. 701–712*).—A lecture delivered April 5, 1895, at the Royal Institution.

Argon and helium, W. RAMSAY (*Compt. Rend., 120 (1895), No. 19, pp. 1049, 1050*).

On calcium carbid and acetylene, BEHRENDS (*Ztschr. angew. Chem., 1895, No. 11, pp. 338, 339*).

A furfurol derivative from levulose, J. KIERMAYER (*Chem. Ztg., 19 (1895), No. 43, pp. 1003–1005*).

Determination of glycogen in hay and in muscles, KESTJAKOWSKY (*Pharm. Ztschr. Russland, 34 (1895), p. 25; abs. in Jour. Pharm. et Chim., ser. 6, 15 (1895), No. 12, p. 613*)

On amylose, EFFRONT (*Compt. Rend.*, *120 (1895), No. 23, pp. 1281-1283*).

A new method for the quantitative determination of glucose, F. GAND (*Rev. Internat. Falsif.*, *8 (1895), No. 10, p. 173*).

On the use of glucosazons for the quantitative determination of dextrose, levulose, and saccharose, C. J. LINTNER and E. KRÖBER (*Ztschr. ges. Brauw.*, *18 (1895), p. 153; abs. in Chem. Ztg.*, *19 (1895), No. 42, Repert., p. 112*).

The estimation of crystallized sugar in raw sugar, etc., by the Karcz method, STROHMER and STIFT (*Oesterr. ungar. Ztschr. Zuckerind. und Landw.*, *1895, No. 24, p. 41; abs. in Chem. Ztg.*, *19 (1895), No. 38, Repert., p. 127*).—The author finds that the Karcz method is not entirely accurate and is not to be recommended for commercial analysis; it may be used, however, in technical control if care is exercised. Under similar conditions the method will give accurate and concordant results.—J. P. STREET.

Sugar estimation, PESKA (*Böhm. Ztschr. Zuckerind.*, *19 (1895), p. 372; abs. in Chem. Ztg.*, *19 (1895), No. 36, Repert., p. 113*).

Sugar estimation, G. OPPERMANN (*Apoth. Ztg.*, *10 (1895), p. 216; abs. in Chem. Ztg.*, *19 (1895), No. 36, Repert., p. 113*).

Ash in glucose sirups and grape sugar, H. E. HORTON (*Jour. Amer. Chem. Soc.*, *17 (1895), No. 5, pp. 403-405*).

Acidity of glucose sirup and grape sugar, H. E. HORTON (*Jour. Amer. Chem. Soc.*, *17 (1895), No. 5, pp. 402, 403*).—An examination of glucose sirups and grape sugars will show an acid reaction, due to acid calcium phosphate (rarely), hydrochloric acid, sulphuric acid, and in most instances to sulphurous acid. The result of the examination of a number of American brands is given.—J. P. STREET.

The ratio of dextrose to levulose in sweet wines as related to their analysis, J. KÖNIG (*Chem. Ztg.*, *19 (1895), No. 43, pp. 999, 1000*).

On the detection of salicylic acid in wine, M. SPICA (*Gaz. chim. Ital.*, *25 (1895), p. 207; abs. in Chem. Ztg.*, *19 (1895), No. 41, Repert., p. 156*).

The estimation of the fatty acids soluble in water containing sulphuric acid, A. ZEGA (*Chem. Ztg.*, *19 (1895), No. 23, pp. 504, 505*).—The author suggests a modification of the Reichert-Meissl method, which he claims is much simpler and more saving of time.—J. P. STREET.

A separation of the fatty acids by oxidation at ordinary temperatures, O. FRANK (*Centbl. Physiol.*, *8 (1895), p. 697; abs. in Chem. Ztg.*, *19 (1895), No. 20, Repert., p. 68*).—After continued extraction of palmitic, stearic, and oleic acids with ether, chloroform, benzol, and methylal, the author obtained a body similar to, but not identical with, stearic or palmitic acid. It was insoluble in water but soluble in the solvents previously named. He concludes that the acid is an oxidation product of fatty acids, due to the action of atmospheric oxygen.—J. P. STREET.

Volumetric estimation of chloroplatinates; estimation of potash, ammonia, nitrogen, and platinum, L. L. DE KONINCK (*Chem. Ztg.*, *19 (1895), No. 39, pp. 901, 902*.)—The method is based on the reduction of the double platinum salt by means of a formate; the author used calcium formate.—J. P. STREET.

On the reduction of oxid of nitrogen by moist iron or zinc, P. SABATIER and J. B. SENDERENS (*Compt. Rend.*, *120 (1895), Nos. 21, pp. 1158-1161; 22, pp. 1212, 1213*).

The gravimetric estimation of phosphoric acid, C. GLÜCKSMANN (*Pharm. Post.*, *28 (1895), p. 153*).

Luteol, a new indicator, W. AUTENRIETH (*Arch. Pharm.*, *233 (1895), p. 43; abs. in Chem. Ztg.*, *19 (1895), No. 36, Repert., p. 113*).—Luteol in alcohol solution gives a clear yellow color with alkaline liquids, where litmus and phenolphthalein fail.—J. P. STREET.

A new method of standardizing acid solutions, E. P. PERMAN and W. JOHN (*Chem. News*, *71 (1895), No. 1856, p. 296*).

An apparatus for the rapid calibration of flasks, pipettes, and burettes, M. BOOT (*Rec. trav. Chim. Pays-Bas*, *13 (1894), p. 417; abs. in Chem. Ztg.*, *19 (1895), No. 36, Repert., p. 109*).

Revolving pipette for measuring fixed amounts of solutions, A. STUTZER (*Ztschr. angew. Chem., 1895, No. 11, p. 309, fig. 1*).—This pipette is practically identical with that devised by Farrington and described in Illinois Station Bulletin 14 (E. S. R., 2, p. 565).

The use of hot air in drying, E. M. COOK (*Jour. Soc. Chem. Ind., 14 (1895), No. 5, pp. 421–426, figs. 3*).

Report of chemical section of Colorado Station, W. P. HEADDEN (*Colorado Sta. Rpt. 1894, pp. 65–69*).—Brief remarks on the work of this department, and an account of the convention of the Association of American Agricultural Colleges and Experiment Stations in 1894.

BOTANY.

The early flora of the Truckee Valley, F. H. HILLMAN (*Nevada Sta. Bul. 24, pp. 95*).—This bulletin is a manual of the more common flowering plants occurring by midsummer within the Truckee Valley, Washoe County, Nevada, and is designed as preliminary to a more complete Flora of Nevada. Twenty-eight orders are described, embracing about 110 genera and 190 species and varieties. A short glossary, defining all technical terms, is appended. The bulletin will no doubt be found valuable to students and others interested in the plants of the region covered.

Flowering of the bamboo (*Roy. Bot. Gard. Trinidad, Misc. Bul., 2 (1895), No. 2, pp. 42, 43*).—The author records the flowering of the bamboo during the present year, said to be an unusual occurrence in the West Indies. It remains to be seen whether or not the seed will mature. An analysis of the seed is quoted[1] as follows: Water 11 per cent, albuminoids 11.8, starch 73.7, oil 0.6, fiber 1.7, and ash 1.2.

The flow of maple sap, A. H. WOOD (*New Hampshire Sta. Bul. 21, pp. 9*).

Synopsis.—Experiments during 3 years in tapping at depths of from 1¼ to 6 in. indicated that the flow of sap is largely dependent upon the depth of the tapping, the deeper the hole the greater the flow, and that the theory that all or nearly all the sap comes from the outer wood is erroneous. The results of comparative tests of tapping the north and south sides of trees favor the latter. A single hole yielded slightly more sap than 2 holes close together.

In order to test the value of deep and shallow tapping of maple trees the author began in 1892 a series of experiments and continued them for 3 years. In 1892 2 trees of approximately the same size were tapped on opposite sides at depths of 1¾ and 3½ in., and the amount of sap collected was compared. More than twice as much sap flowed from the deep tapping as from the other. In 1893 similar experiments were conducted on other trees, and the rate of flow per minute determined. It was found that the tapping at 1¼ in. gave the least flow and at 2½ in. the most. When the holes in trees which had been tapped to a depth of 1¼ in. were deepened to 2½ in. the increased flow was very marked.

[1] Church: Food Grains of India.

A tree about 12 in. in diameter was tapped about 2 in. deep with a 1-inch bit, the hole was then bored 2 in. deeper with a $\frac{1}{2}$-inch bit, and the sap collected from the inner and outer wood. The rate of flow was 9 cc. per minute from the inner wood, and 6 cc. per minute from the outer. The same experiment was repeated a few days later, and in both trees it was found that the flow from the inner wood exceeded that from the outer wood, although the diameter of the outer hole was double that of the inner one.

In 1894 four trees were tapped, and it was shown that the flow from the inner wood of the first tree, which was bored $2\frac{7}{8}$ in. deep with two different sized bits, a $\frac{13}{16}$ inch and a $\frac{3}{8}$-inch, exceeded that from the outer wood. In the second tree, where the hole was of uniform diameter, the flow from the inner wood was almost double that from the outer. It was also shown that in the fourth tree, which was tapped to a depth of 6 in., the hole being $\frac{1}{4}$ in. in diameter, the flow was nearly equal to that in the others, where much larger openings were made.

The author concludes that the flow of sap is very largely dependent upon the depth of the tapping, and that the theory that all or nearly all the sap comes from the outer wood is erroneous The additional injury to the tree by deep tapping is very slight, especially if the hole is small. Where a $\frac{3}{8}$-inch bit is used and the bark practically uninjured by hewing, the majority of the holes will be grown over the first summer after tapping.

The amount of flow of sap from the north and south sides of trees was investigated, and it was found that under equal conditions the common practice of tapping on the south side of trees is to be preferred.

The tendency of tapping trees twice, putting the holes near together, and letting the sap from both spouts go into the same bucket was tested and it was found that trees tapped once gave slightly more sap than those which were tapped twice. This conclusion is based upon a single trial and should be confirmed by subsequent investigation.

Concerning the occurrence of glutamin in the green parts of plants, E. SCHULZE (*Ztschr. Phys. Chem., 20 (1891), No. 3, pp. 327–334*).—The author has found glutamin present in the green parts of *Pteris aquilina*, *Aspidium filix-mas*, *Asplenium filix fœmina*, *Saponaria vulgaris*, and the leaves of *Beta vulgaris*. The methods of treatment are given in detail, the crystallized product being glutaminate of copper. The author states that glutamin has been found in the roots of *Beta vulgaris*, etiolated seedlings of *Cucurbita pepo*, root tubers of *Stachys tuberifera*, and in etiolated seedlings of *Helianthus annuus*.

The moth-catching plant, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Gardeners and Fruit Growers No. 2, pp. 2, figs. 2*).—Illustrated notes on *Arauja albens*, which entraps moths by holding their probosces when those organs are thrust into the corolla of the flower in search of nectar. The common name of "codling-moth plant" is believed to be a mistake, as no specimens of this insect have ever been noticed caught.

List of exotic trees and shrubs affected by Australian Loranthus and Viscum, F. TURNER (*Proc. Linn. Soc. N. S. W., 9 (1895), No. 3, pp. 557–560*).—A list of 27 species of trees and shrubs in 13 orders that are affected by mistletoes is given.

Calcium oxalate crystals in the so-called seed coats of Umbelliferæ and their value in systematic classification, J. ROMPEL (*Bot. Centbl., 62 (1895), No. 9, pp. 282, 283*).

Herbaria in their relation to botany, J. P. LOTSY (*Pop. Sci. Monthly, 1895, July, pp. 360–363*).

Notes for the description of the Hymenomycetes, M. BRITZELMAYER (*Bot. Centbl., 62 (1895), Nos. 9, pp. 273–281; 10, pp. 305–313*).

Notes on some specimens of Pyrenomycetes in Schweinitz herbarium, J. B. ELLIS (*Proc. Phila. Acad. Sci., 1895, I, pp. 20–31*).

Concerning the development and systematic arrangement of the Saprolegniaceæ, A. MAURIZIO (*Flora, 1894; abs. in Bot. Centbl., 62 (1895), No. 10, pp. 321, 322*).

The kola nut, F. B. KILMER (*Bul. Jamaica Bot. Gardens, 2 (1895), No. 5, pp. 103–106*).

Concerning Knight's experiments on tuber formation, a critical and experimental investigation, H. VOCHTING (*Bot. Ztg., 53 (1895), No. 4, pp. 79–106, table 1*).

Notes on Penicillium growing in solutions of copper sulphate, L. TRABUT (*Bul. Soc. Bot. France, 42 (1895), No. 1, pp. 33, 34*).—A report is given of a species of Penicillium growing in 9[1] per cent copper sulphate. It differs from *P. glaucum* and the author has given it the name *P. cupricum.*

Concerning the biology of some plants with underground shoots, A. RIMBACH (*Ber. deut. bot. Ges., 13 (1895), No. 4, pp. 141–155, table 1*).

On a new method of studying cell motion, C. L. LEONARD (*Proc. Phila. Acad. Sci., 1895, I, pp. 38, 39*).

A contribution on the development of the fruiting organs of some Gasteromycetes, L. RABINOWITSCH (*Flora, 1894; abs. in Bot. Centbl., 62 (1895), No. 10, pp 322–324*).

Notes on the methods of fertilization of the Goodeniaceæ, II, A. G. HAMILTON (*Proc. Linn. Soc. N. S. W., 9 (1894), No. 2, pp. 201–212, pl. 1*).

Investigations on geotropism, F. CZAPEK (*Pringsheim's Jahrb. wiss. Bot., 27 (1895), No. 2, pp. 243–338; abs. in Bot. Centbl., 62 (1895), No. 11, pp. 352–358*).

On some of the properties of protoplasm, A. SABATIER (*Rev. Sci., ser. 4, 3 (1895), No. 19, pp. 585–590*).

A contribution to the knowledge of the root systems of culture plants, C. KRAUS (*Forsch. Geb. agr. Phys., 18 (1895), No. 1 and 2, pp. 113–166*).—Third article of "Investigations concerning the root growth of culture plants in its physiological and cultural relations."

The availability of different sugars as plant food, G. DE CHALMOT (*Agl. Sci., 8 (1895), No. 12, pp. 568–571*).

The relations of earthworms to rhizome plants, especially the beech, P. E. MÜLLER (*Kgl. vidensk. Selsk. Forh., 1894, pp. 47–147; abs. in Forsch. Geb. agr. Phys., 18 (1895), No. 1 and 2, pp. 100–104*).

Some unusual androgynous flower clusters, J. G. JACK (*Garden and Forest, 8 (1895), No. 380, pp. 222, 223, fig. 1*).—Illustrated descriptive remarks on some sexually perfect blossoms observed on *Pinus heterophylla, Picea canadensis,* and *Betula papyrifera.*

Concerning the influence of situation on the variability of species of plants, F. KRASAN (*Mitt. naturw. Verein. Steiermark, 1894, pp. 296–309*).

The development of botany in Germany during the nineteenth century, E. STRASBURGER (*Bot. Gaz., 20 (1895), Nos. 5, pp. 193–204; 6, pp. 249–257*).

A vegetable physiological Practicum, a guide to investigations in plant physiology, W. DETMER (*Jena: G. Fischer, 1895, pp. XVI, 456, figs. 184*).

A text-book of biology, F. LUDWIG (*Lehrbuch der Biologie. Stuttgart: Enke, 1895, pp. 600, figs. 28; abs. in Bot. Centbl., 62 (1895), No. 11, pp. 358, 360*).

Elementary treatise on anatomical and physiological botany, L. GERARDIN (*Traité elementaire d'histoire naturelle Botanique, anatomie et physiologie vegetales. Paris: Baillière, pp. 485, figs. 535*).

Botanical work of the Government, J. M. COULTER (*Bot. Gaz., 20 (1895), No. 6, pp. 264-268*).—A list is given of those connected with the United States Department of Agriculture whose duties are botanical and the special lines of their work indicated.

BACTERIOLOGY.

Ascus formation in yeast, H. SCHIONNING (*Compt. Rend. Lab. Carlsberg, 4 (1895), No. 1; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 12, pp. 441, 442*).

On the enzyme of Schizo-saccharomyces octosporus and Saccharomyces marxianus, E. FISCHER and P. LINDNER (*Neue Ztschr. Zuckerind., 34 (1895), No. 24, p. 280*).

Investigations on Saccharomyces marxianus, S. apiculatus, and S. anomalus, A. KLOCKER (*Compt. Rend. Lab. Carlsberg, 4 (1895), No. 1; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 12, pp. 446-449*).

Tubercle bacilli in human milk, with report of two cases, S. COLES (*Phila. Polyclinic, 1894, p. 131*).

Concerning the detection of tubercle bacilli in milk, K. ARNELL (*Kgl. Landt. Akad. Handl. Tidskr., 1894, pp. 231-243; abs. in Centbl. Bakt. und Par. Med., 17 (1895), No. 20, p. 726*).

A contribution to the bacteriology of gastric fermentation, J. KAUFMANN (*Abs. in Centbl. Bakt. und Par. Med., 17 (1895), No 18 and 19, pp. 617, 618*).

The action of light on bacteria and fungi, H. M. WARD (*Proc. Roy. Inst., 14 (1895), II, No. 88, pp. 259-279*).

Progress in the domain of bacteriology, V. GERLACH (*Chem. Ztg., 19 (1895), No. 40, pp. 929-931*).—Principally devoted to a review of work on pathogenic organisms.

A course in elementary practical bacteriology including bacteriological analysis and chemistry, KANTHACK and DRYSDALE (*London: MacMillan & Co., 1895, pp. 185*).

METEOROLOGY.

Some physical aspects of the new gas, argon, the ideal thermometrical substance for high temperatures, W. R. QUINAN (*Jour. Amer. Chem. Soc., 17 (1895), No. 6, pp. 477-483*).—The kinetic theory of gases is explained and it is pointed out that in the sense of this theory argon is a monatomic gas and therefore when used as a thermometrical substance at a very high temperature is not subject to the fatal theoretical defects possessed by hydrogen and nitrogen, the elementary gases commonly used for this purpose.

"Argon, as a thermometric substance at ordinary temperatures, has about the same properties as nitrogen or oxygen. It is a permanent gas with a low critical point —121° C. Its behavior under the usual conditions will be very similar to that of the mixture of nitrogen and oxygen we call air; its scale is therefore strictly comparable with that of the air thermometer.

"At high temperatures it is the ideal thermometric substance.

"Neglecting dissociation, all gases improve in their behavior as the temperature rises; all discrepancies pass into the normal which do not affect the scale of temperature of either the constant-volume or constant-pressure thermometer.

"Argon has no internal energy; the decomposing influence of the heat is absent; in other words, being monatomic it can not suffer dissociation and its behavior as a thermometric substance throughout the range of temperature will be strictly normal. No other substance has such simple heat relations over such a great range of temperature."

Rainfall in the East Indian Archipelago, 1893 (*Batavia, 12 (1893), pp. 416*).—This volume forms the fifteenth in the annual series of rainfall statistics published by direction of the Government of Netherlands India under the superintendence of Van der Stok. During the year 1893 194 stations were in operation, of which 104 were in Java and Madura and 90 in Sumatra and the different islands of the Eastern Archipelago. Average monthly values deduced from observations made during 5 to 15 consecutive years are given for 185 stations. The greatest quantity of rain recorded as falling during 24 hours in 1893 was 327 mm. (12.9 in.) at Pameungpek in September. Alas-Petoeng has the greatest mean annual (9 years) with 4,603 mm. (181.2 in.). Batavia has a mean annual rainfall of 1,784 mm. (70.2 in.) from 15 years observations; mean number of rainy days, 135; the greatest fall in 24 hours during 1893 was 125 mm. (4.9 in.) in February.—O. L. FASSIG.

Meteorological Observatory of St. Louis at St. Hélier, Island of Jersey.—During the year 1894 a meteorological observatory was erected upon this island at lat. 49° 12′ 4″ N., long. 2° 4′ W. of G., under the direction of the Jesuits. The observatory is about 55 meters above the level of the sea. A tower 50 meters high has been erected for the study of winds and atmospheric electricity. The anemometer will be placed at an elevation of 110 meters above sea level. The director is Rev. Marc Dechevrens, formerly of the Zi-Ka-Wei Observatory, near Shanghai, China.

The first results of observations are contained in the *Bulletin des observations météorologiques, 1 (1894), pp. 30.* The bulletin contains monthly means of the usual elements derived from four daily readings or from self-recording instruments. Monthly means for each hour of the day are given for the entire year for pressure and temperature. The observatory promises to take rank among the first order of observatories devoted to meteorology and terrestrial magnetism.—O. L. FASSIG.

Meteorological observations at Maryland Station, R. H. MILLER and H. J. PATTERSON (*Maryland Sta. Rpt. 1894, pp. 180, 181, 186*).—Tables show the rainfall at College Park, 1889–'94, and normal and mean temperature; normal rainfall and rainfall in 1894 at College Park, Maryland; Washington, D. C.; Baltimore, Maryland; and Cumberland, Maryland; and monthly summaries of observations on precipitation and temperature at College Park. The yearly summary for College Park is as follows: Temperature (degrees F.): Mean, 54.5; highest, 100 (July 13); lowest, 11. Precipitation (inches), 33.20.

"The season of 1894 has been an abnormal one in many respects, and therefore unfavorable for experimental field work. Unusually warm weather during the latter part of March forced vegetation forward very rapidly; fruit trees coming out in full bloom, and winter grains making an unusual growth. Following quickly on this came a very severe frost, the temperature on the 28th dropping down to 16.5°. As a result a large part of the fruit was killed, and in many sections of the State the wheat, which was unusually succulent and tender owing to the rapid growth it had made, was seriously injured by the weakening of the straw. While affecting more or less the varieties seeded at the station, and causing grave apprehensions at the time, the results at harvest proved that only a few of the varieties had sustained serious injury. The rainfall during the season when vegetation is most in need of moisture, from the middle of June to the middle of August, was only about one-half the normal for that period. As a result of this many of our crops, notably potatoes (both the early and the late crop), were very seriously injured, particularly the early ones, which were killed off within a few days. This extremely dry weather during the summer months has been very discouraging to those who have sown crimson clover, especially those who made their first attempt with it the season of 1893, and failed owing to the severe drought of that year."

Meteorological report for Trinidad, 1894, J. H. HART (*Roy. Bot. Gard. Trinidad, Rpt. 1894, pp. 17–23, chart 1*).—The history of the meteorological service of the Island of Trinidad is briefly reviewed, and tables show monthly summaries of observations on air pressure, temperature, rainfall, and humidity at the Royal Botanic Gardens for 1894; annual rainfall at the Botanic Gardens for 1862 to 1894, inclusive, and a record of rainfall at 105 different stations in the Island during 1894. A chart showing the course of hurricanes for the West Indies is added. The mean daily height of barometer during 1894 was 29.97 in., mean annual temperature 78.45° F., total rainfall 52.21 in. at the Botanic Gardens. The mean rainfall for the year at 63 stations in the Island was 68.45 in. The average rainfall at the Botanic Gardens during 33 years (1862–'94) was 67.5 in.

Investigations of the influence of climate on health, M. W. HARRINGTON (*U. S. Dept. Agr., Weather Bureau, Sanitary Climatology Circulars Nos. 2, p. 1; 3, p. 1; 4, pp. 7*).—Directions and forms are given for the collection of vital statistics, and the methods to be pursued in the compilation of the data obtained is explained.

"A publication containing the collected and compiled facts will be issued monthly. This publication will comprise, in the shape of tables, charts, and diagrams, the chief meteorologic factors as observed and recorded by the officials of the Weather Bureau, and the statistics of mortality and morbidity as reported by the various public health officials and by individual physicians; also brief statements of the general sanitary conditions of the different localities, especially as they may have been influenced by the weather."

Weather observations and predictions (*Nature, 52 (1895), No. 1335, pp. 98–100*).—Review of two books, one by Thomas Russell and the other by H. C. Russell.

Five days' storms in Bohemia, May 20–25, 1895, C. V. ZENGER (*Compt. Rend., 120 (1895), No. 23, pp. 1299–1301*).

The moon, T. GWYN ELGER (*London: George Philys & Son, 1895, pp. 174*).

Meteorological observations at Camden, Arkansas, 1894, C. L. NEWMAN (*Arkansas Sta. Bul. 34, p. 128*).—Monthly and annual summaries of observations on temperature, precipitation, and cloudiness during 11 months (February to December). The highest temperature recorded was 103° F. (July 1 to 4), the lowest 8° (Dec. 28, 29).

Meteorological observations at Massachusetts Hatch Station, F. L. Warren (*Massachusetts Hatch Sta. Met. Bul. 76, pp. 4*).—A summary of observations during April, 1895, at the meteorological observatory of the station. The mean temperature for the month was one degree above the normal. The season was backward on account of excessive rainfall (5.50 in.), which was 2¼ in. above normal and the greatest observed at Amherst since 1857.

Meteorological summary for North Carolina, March, 1895, H. B. Battle, C. F. von Herrmann, and R. Nunn (*North Carolina Sta. Weather Service Bul. 66, pp. 35–40, maps 2*).—The usual summaries of observations by the State Weather Service coöperating with the Weather Bureau of this Department.

Rainfall at Wichita Falls and McKinney, Texas, during 1894 (*Texas Sta. Bul. 34, p. 561*).—Summaries of rainfall during 9 months (April to December).

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 22 (1894), No. 12, pp. 487–533, charts 7*).—In addition to the usual summaries of observations this number contains notes by the editor on temperature of water of Sebago Lake, Maine; the storm at Ponta Delgada, December 8, 1894; observations at Honolulu, Hawaii; meteorology in the schools; origin of storms; and on various local weather phenomena.

SOILS.

Disintegration of the granitic rocks of the District of Columbia, G. P. Merrill (*Bul. Geol. Soc. America, 6, pp. 321–332, pl. 1*).—This article includes description of locality, bulk analyses, analyses of material separated by solvents, analyses of material mechanically separated, conditions affecting the results, analyses of material from other localities, time limit of disintegration, and causes of disintegration.

The investigations of the author indicate that "the chief alteration in the conversion of the barren rock into arable soil is physical, attended probably with a partial change in the mode of combination of the various elements;" that the disintegration, extending in some cases to a depth of 50 or more feet, is almost wholly post-Cretaceous; and that hydration seems to be the most pronounced and most nearly universal agency of decomposition.

The effect of bisulphid of carbon on exhausted or "sick" (fatigués) soils, C. Oberlin (*Jour. Agr. Prat., 59 (1895), Nos. 13, pp. 459–461; 14, pp. 499–503; 15, pp. 535–540*).—In the course of experiments carried on during 18 years under the direction of the author in treating the grape phylloxera with bisulphid of carbon it was observed that this substance had a remarkable effect in increasing the yield of crops.

In the treatment of phylloxera in Alsace-Lorraine holes are made in the ground about the diseased vines with an iron rod to a depth of 50 to 60 cm., from 50 to 100 cc. of bisulphid poured in, the holes carefully plugged, and, if necessary, the surface of the soil puddled in order to prevent the escape of the fumes. As a rule in vineyards thus treated the vines are removed and destroyed and grapes are not planted again for six years, but the land is used for other crops, especially alfalfa.

In this way it has been possible to make observations on a variety of crops including legumes, sugar beets, and cereals grown on soil treated with bisulphid of carbon as compared with those grown on untreated soil.

It was observed that oats on soil thus treated were decidedly superior to those on untreated soils, the conditions being such that the result could only be attributed to the effect of the bisulphid.

It was further observed that soil made "sick" by continuous culture of the same crop was restored to productiveness by the use of bisulphid. After 6 years' continuous culture alfalfa failed on soil not treated with bisulphid, while parallel plats to which it had been applied produced a vigorous growth, the growth being especially rank over the spots where the bisulphid was applied. Similar results were obtained with hairy vetch and beans. With crimson clover on treated and untreated soil little difference was observed in the early stages of growth, but later during the winter the clover on the treated plat was much more thrifty than that on the untreated plat.

Just what the action of the bisulphid is in the soil is not clear from present knowledge. Does it destroy all soil parasites alike or only certain classes? Is its effect due to chemical action in the soil? Will the beneficial effect observed the first year continue during succeeding years? Is the cure of "sickness" in case of legumes, for instance, due to the destruction of the excess of organisms in the soil, and is it a permanent cure, or will the treatment have to be repeated each year? If, as suggested, "sickness" is due to an excess of organisms in the soil, is not soil inoculation for legumes of doubtful value? These are interesting questions which demand further study.

A bacteriological examination of the wells in the vicinity of Berne, A. Seiler (*Inaug. Diss. Berne, 1894, pp. 45; abs. in Centbl. Bakt. und Par. Med., 17 (1895), No. 18 and 19, pp. 672–674*).

The influence of the temperature of the soil on the moisture content of the upper layers of the soil, W. Wiese (*Mündener forstl. Hefte, 5, pp. 81–91; abs. in Forsch. Geb. agr. Phys., 18 (1895), No. 1 and 2, pp. 99, 100*).

The loss of nitric nitrogen through drainage water (*Prog. Agr. et Vit., 17 (1895), No. 17, p. 452*).

Researches on the drainage waters of cultivated soils, P. P. Dehérain (*Ann. Agron., 21 (1895), No. 5, pp. 193–207*).—See abstract E. S. R., 6, p. 977.

Researches on assimilable nitrogen and its transformation in the soil, Pagnoul (*Ann. Agron., 21 (1895), No. 5, pp. 207–225*).—See abstract E. S. R., 6, p. 118.

Phosphoric acid in moor soils (*Fühling's landw. Ztg., 44 (1895), No. 10, pp. 319, 320*).

On the accumulation in the soil of the copper compounds employed in combating fungus diseases of plants, A. Girard (*Jour. Agr. Prat., 59 (1895), No. 23, pp. 815–817*).

Examination of soils, F. W. Morse (*New Hampshire Sta. Rpt. 1893, pp. 131, 132*).—Chemical analyses of 3 samples of surface soil and 2 of subsoil from the experimental field of the station are reported.

FERTILIZERS.

Leguminous plants for green manuring, SCHULTZ-LUPITZ (*Abs. in Deut. landw. Presse, 22 (1895), No. 27, pp. 253–255, figs. 7*).—In studying the root growth of leguminous plants the author found no constant relation between the length of root and of stem. In a dry season when naturally the top growth was not great the roots penetrated deep, those of lupine extending 5 ft. down. In a wet season they did not reach so deep, but root tubercles were more abundant.

Potatoes when grown the year after lupines sent their roots to a much greater depth than when the preceding crop was wheat. After lupines the potato roots followed the course of the decayed lupine roots and thus penetrated a hard stratum of soil, through which they were not able to pass, on the area where no lupines had been grown. The depth to which potato roots penetrated was, after wheat, 16 to 18 in., after lupines, 48 in. The yield was much greater on the field where the roots went deep enough to reach the moist strata of the soil.

For potatoes green manuring with lupines was found to be much more profitable than the application of stable manure. Lupines proved highly satisfactory as a green manure for rye.

On the light soils of Lupitz blue lupine proved deeper rooted than the white and yellow kinds and in general appeared to be more satisfactory for green manuring.

The world's consumption of fertilizers—sulphate of ammonia, MAIZIÈRES (*L'Engrais, 10 (1895), No. 15, pp. 317, 318*).—The production of sulphate of ammonia in different countries in 1893 is given as follows:

Production of sulphate of ammonia.

	Tons
England	154,000
Germany, Austria, and Russia	67,000
France	26,000
Belgium and Holland	20,000
America	15,000
Other countries	8,000
Total	290,000

The production in England in 1892 was 157,000 tons. Of this 112,000 tons came from gas works, 12,000 tons from furnaces, 28,000 tons from schists, and 5,000 tons from coke ovens.

The world's consumption of fertilizers—blood, meat, horn, and leather, MAIZIÈRES (*L'Engrais, 10 (1895), No. 16, pp. 371, 372*).—The production of these materials at the present time is estimated to be as follows:

Production of blood, meat, horn, and leather.

	Blood and meat.	Horn and leather.
	Tons.	*Tons.*
France	8,000	8,500
Belgium	3,000	4,000
England	7,000	8,000
Germany	6,000	6,000
Russia	3,000	....
America	18,000	8,000
Other countries	6,000	10,000
Total	51,000	44,500

The world's consumption of fertilizers—guano, MAIZIÈRES (*L'Engrais, 10 (1895), No. 19, pp. 413, 414*).—The following are given as the amounts of guano imported into Europe, 1889–'94:

Guano imported into Europe, 1889–'94.

	1889.	1890	1891.	1892.	1893.	1894.
	Tons.	*Tons*	*Tons*	*Tons*	*Tons*	*Tons.*
England	14,000	15,000	8,000	14,000	10,000	16,000
Ireland	2,000	1,000	2 000	.....	....	2,000
Scotland	1 000	3,000	1,000	....	.....	....
France	4,000	3,000	5,000	.. .	1,000	2,000
Belgium	20,000	21,000	13,000	9,000	18,000	20,000
Holland	...	......	......	......	......	....
Germany	7,000	7,000	3,000	4 000	8,000	13,000
Spain, Canary and Mediterranean islands, etc	2,000	12,000	3,000	......	....	......
Total	50,000	65,000	35,000	27,000	37 000	53,000

Tennessee phosphate rocks, J. M. SAFFORD (*Tennessee Bureau of Agr. Rpt. 1893–'94, pp. 211–221, fig. 1*).—This article contains a somewhat popular account of the composition, characteristics, and geological relations of the Tennessee phosphates in general, with a more technical discussion of the origin of material and other theoretical considerations by the State geologist, and a note on the white phosphates of Tennessee by G. W. Hayes, of the United States Geological Survey.

The phosphate rocks of Tennessee are closely associated with a persistent, approximately horizontal formation, the Black Shale or Black Slate. There are two chief beds of phosphate, one immediately above the shale, the other immediately below it.

"The phosphate beds are, geologically, a thousand feet below the lowest of the coal beds. This shows that Tennessee phosphates are very different in age from the beds of South Carolina and Florida. The latter are far younger than the coal, and are, indeed, among the latest of geological formations.

"The rocks of the limestone floor are, in the language of geologists, of Silurian age. The formations above the Black Shale group are sub-Carboniferous; or, in later language, Mississippian. Sandwiched between these, or say, between the limestone floor and the Harpeth Shale, lie, in comparatively thin layers, the four members of the Black Shale Group."

These, commencing with the lowest, are sandstone, main phosphate bed, Black Shale, and kidney phosphate.

"The main phosphate has a wide distribution. In all the counties west of the meridian of Nashville, and between that and the Tennessee River, the rock, in its proper geological horizon, is to be found. It even extends beyond the river into Decatur and Benton counties. It lies, as we have seen, below the Black Shale, and everywhere, in the region indicated, goes with it. . . . But it must not be understood that it has practical importance in all this wide territory; not by any means. As a rule, it is generally too thin or too sandy or limey to be of value. The best of it, the thickest and purest, is found in a comparatively limited area or belt of country lying chiefly in Lewis and Hickman counties."

Good workable phosphate is found throughout Swan Creek Valley in these counties, and here the most active mining operations are carried on.

"The rock ranges from 6 to 40 in. in thickness and contains from 60 to 75 per cent of phosphate. . . . The length of the Swan Creek belt holding phosphate is 20 miles; say its width is 3 miles, then we have an area of 60 square miles. Suppose but one-third of the phosphate of this area to be available, with these liberal limitations, our belt gives us more than 123,000,000 tons."

"[The phosphate of this bed] is sometimes dark-colored and fine-grained, as if it might be compressed gunpowder. This variety oxidizes on exposure, so as to form a yellowish crust or layer, giving the rock very much the appearance of a sandstone. But it lacks the hard grit of sandstone, and this leads to its recognition.

"Then again it is light-colored, or gray, and made up chiefly of small seed-like or grain-like bodies, or of a multitude of minute spiral shells. Sometimes thin layers are met with that ring like pot-metal when thrown down or when struck with a hammer. Locally it is found thoroughly disintegrated, oxidized, whitened, and resembling clay. The coloring matter of the darker kinds is organic, derived either from plants or animals, or both. Hence such kinds oxidize and burn white, or to a much lighter color. Several species of the minute shells occur, and also worn teeth, and sometimes fragments of fish bones. . . .

"The bed of Kidney Phosphate, thick, thin or in traces, is well nigh universally found in its place above the Black Shale. It is a stratum of roundish, solid, phosphatic concretions, from the size of marbles to masses as large as one's head, or to flattish, cake-like, kidney-like, gourd-like forms of larger size. At certain localities they are to be seen, with a little shale, tightly packed together, as if so many cannon balls, in a layer 8 to 12 in., or exceptionally 18 in., in thickness; or else loosely disposed and embedded in greenish shale. The latter is itself more or less phosphatic, and is quite generally found in association with the balls. . . .

"When long exposed the kidneys weather externally to a grayish or whitish coat. When broken they show a brownish gray color, with a center, often of open, granular structure, somewhat oölitic. They contain from 60 to 65 per cent of calcium phosphate, and yield an approved fertilizer. When the balls and the lower phosphate are separated by only a few inches or a foot of Black Shale they may be mined together, making it profitable, where the mining of one alone would not be."

The theoretical considerations are presented which lead to the conclusion that these deposits have been derived from the remains of fish and other marine animals deposited during the Devonian age.

Two varieties of white phosphate (1) breccia phosphate and (2) white bedded phosphate "resembling more or less closely the Florida rock" have been found in Perry County, but their content of phosphate of lime (27 to 33 per cent) is too low for them to be of much commercial importance.

The marls and phosphates of North Carolina, F. B. CARPENTER (*North Carolina Sta. Bul. 110, pp. 455–504, map 1*).—A summary of information on the location and extent of the marl and phosphate deposits of North Carolina and tables of analyses of many hundred samples compiled from the station records, with a description of the geological features of the formations, and notes on distribution, varieties, and uses, including a chapter on the manufacture of superphosphates.

"Of North Carolina's mineral resources there is none which is of so much interest to the agricultural community as her beds of marls and phosphates. These deposits are distributed throughout the eastern portion of the State, and belong to one of the largest formations of the kind in the world The portions of the Cenozoic and Mesozoic eras, which include these deposits, may broadly be said to extend along the coast of the Atlantic Ocean and the Gulf of Mexico from New Jersey to Texas. While the marls are not as rich in some fertilizing ingredients as the famous green sand marls of New Jersey, and the deposits of phosphates thus far discovered are less valuable than those of South Carolina, the supply is very extensive, and if properly utilized will prove of material value to the farming community, especially in the eastern portion of the State. These deposits of phosphates and marls are in many cases so closely connected that there is seen a great variety of material, ranging from a nearly pure carbonate of lime containing a trace of phosphate to that of a high-grade phosphate with only a small content of carbonate of lime. In addition to phospate of lime and carbonate of lime, the green sand varieties contain an appreciable percentage of potash. The value of all the different deposits is largely affected by the varying percentages of sand or other worthless material which they may contain. . . .

"Coprolites have been known for many years to occur in the marl deposits of the East and in the Triassic regions in Rockingham, Stokes, Chatham, and Moore counties, but it was not known that phosphates existed in sufficient quantities to be of agricultural value until the deposits at Castle Hayne were discovered in 1883 through the means of this station. . . . Since that year the station has assisted landowners who were interested in the development of these natural resources upon their property. . . .

"The most important phosphate deposits in North Carolina thus far investigated lie in a belt 15 to 20 miles wide, extending from the South Carolina line northeastward with a trend of the coast to the Neuse River. It runs through the counties of Columbus, Bladen, Sampson, Duplin, and includes a small part of Pender, Lenoir, Jones, and Onslow. A conglomerate of phosphatic nodules and marl, less rich in phosphate than the preceding, lies just below this and extends southward through Pender and New Hanover counties nearly to the coast.

"For home consumption the North Carolina phosphates are beginning to be considerably used and might be more extensively utilized, especially in the vicinity of the deposits. . . .

"For convenience the products of these deposits can be divided into two classes, those which contain sufficient phosphoric acid for the profitable manufacture of acid phosphate for commercial use, and the lower grades, which can only be profitably used in the vicinity of the production. The manufacture of North Carolina acid phosphate is now being carried on to a considerable extent compared with former years. It has been found that an article containing from 10 to 13 per cent available phosphoric acid can be made at comparatively small cost. While the rock is not quite as high grade as that from South Carolina, it grinds readily and takes about one-third less acid, thus reducing the cost of manufacture, at the same time retaining a good percentage of phosphoric acid. . . .

"The lower grades of rock and the marls containing phosphoric acid, while they can not be profitably used in the manufacture of acid phosphate, will prove valuable for home use. The small cost at which they can be procured will doubtless make it profitable to ship them a considerable distance."

The action of lime and magnesia on the soluble phosphoric acid of the soil, C. SCHREIBER (*Rev. Agron. Louvain, 4 (1895), No. 1, pp. 66–69*).—Two complete fertilizers, one containing dicalcium phosphate mixed with sulphate of lime and carbonate of magnesia, and the other phosphate of soda with carbonates of lime and magnesia, were compared in experiments with oats and turnips on sandy, humus, and loam soils. The fertilizers were applied to the oats, which were followed by the turnips without further addition of fertilizers.

In every case the yield was much lower with the second fertilizer, the difference being particularly marked in case of turnips. This result was apparently due to the action of the carbonates of lime and magnesia in rendering the phosphoric acid of the phosphate of soda insoluble. The differences were more marked in case of the turnips because the retrograde action had become more complete.

The results of experiments on the humus soil confirmed the conclusions drawn by the author from previous experiments[1] that the phosphoric acid combined with the humus of moor soils which is readily soluble in alkaline ammonium citrate is almost useless for vegetation. Under certain circumstances, therefore, humus exerts on assimilable phosphoric acid an influence analogous to carbonate of lime.

The assimilation of the plant food of soils by plants, J. KÖNIG and E. HASELHOFF (*Landw. Jahrb., 23 (1894), No. 6, pp. 1009–1030, pls. 3*).—After a brief review of the work of other investigators in this line[2] the authors report experiments made by them with barley and horse beans on 2 artificial soils. These soil mixtures had the following composition:

Artificial soil mixtures.

	1.	2.
	Per cent.	*Per cent.*
Humus (from sugar)	2.5	2.5
Iron hydroxid	2.5	3.0
Aluminum hydroxid	0.7	0.3
Hydrate of silica	0.2	0.2
Clay	10.0	10.0
Zeolite { Natrolite ... 0.5; Desmine ... 0.8; Heulandite .. 0.7 }	....	2.0

The absorptive power of these mixtures was tested by 2 methods with solutions of chlorid and nitrate of calcium, sulphate of potash, sulphate of magnesia, chlorid of ammonia, nitrate of soda, and superphosphate, each in 2 different degrees of concentration. In general from one-seventh to one-fourth of the lime, zero to one-third of the

[1] Monographie agricole des terrains des Linbourg, 1893, part 1.

[2] A notable omission in this review is the work of Dyer on Rothamsted soils (E. S. R., 5, p. 1013).

magnesia, one-fifth to one-half of the potash, and only traces of soda and sulphuric acid were absorbed, while phosphoric acid was completely retained. The addition of zeolite increased the amounts, especially of lime, magnesia, and potash absorbed, practically the same amounts being absorbed from the two solutions.

For the experiments with barley, glazed earthernware pots holding about 6 kg. were filled to a height of 8 cm. with sand (about 2 kg.) then to a height of 21.5 cm. with the soil mixtures (4 kg.). Six series of pots with each mixture were prepared, 1 series in each case receiving no fertilizer, while 5 were fertilized as shown in the following table:

Fertilizers used in pot experiments with barley.

	1.	2.	3.	4.	5.
	Per cent.	*Per cent*	*Per cent.*	*Per cent*	*Per cent.*
Plant food in soluble form	100	50	25	10	....
Plant food in insoluble form	....	50	75	90	100
	Grams	*Grams*	*Grams*	*Grams.*	*Grams.*
Potash as potassium sulphate	7.500	3.750	1.875	0.750	....
Potash as orthoclase	....	12.000	18.000	21.600	24.000
Phosphoric acid as double superphosphate	7.600	3.800	1.900	0.760	....
Phosphoric acid as ground South Carolina rock	....	6.070	9.120	10.950	12.140
Nitrogen as calcium nitrate	6.560	3.280	1.640	0.656	....
Nitrogen as horn meal	....	4.000	6.000	7.200	8.000
Lime as calcium nitrate	6.560	3.280	1.640	0.656	....
Lime as calcium carbonate	....	2.000	3.000	3.600	4.000
Magnesium sulphate	1.968	1.968	1.968	1.968	1.968
Chlorid of sodium	0.234	0.234	0.234	0.234	0.234

The moisture was kept at 60 per cent of that required for complete saturation in pots filled with mixture 1, and 75 per cent in those filled with mixture 2.

The growth of barley was very poor on the check pots receiving no fertilizer, showing that the soil mixture contained little food assimilable by this plant. It was slightly better, however, on mixture 1 than on mixture 2, due probably to the fact that the former had been mixed about 6 months before the beginning of the experiment and had weathered to some extent, while the latter was mixed just prior to use in the experiments.

Although the results in the different series were somewhat irregular on account of the unfavorable physical properties of the soil they agree in general in showing that the yields increased with the increase of soluble fertilizing constituents present.

From analyses of the crop the following table is calculated, showing the extent to which the leading fertilizing constituents in the soluble and insoluble forms were assimilated:

Amounts of soluble and insoluble fertilizing constituents absorbed by barley.

	1.	2.	3.	4.	5.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Nitrogen	29.68	37.18	81.57	154.64	7.84–15.39
Phosphoric acid	4.42	4.23	8.36	14.60	0.20– 1.00
Potash	12.45	17.16	31.85	47.80	0.30– 2.87
Lime	7.09	10.55	18.55	29.91	0.94– 2.36

It appears that only a comparatively small percentage of the soluble lime and phosphoric acid was absorbed, while much larger amounts of potash and nitrogen (especially the latter) were utilized. It will be seen also that only small amounts of the insoluble constituents were assimilated.

The experiments with horse beans were conducted on the same soil mixtures 2 years later. To prevent packing, more sand was used in the bottoms of the pots and 200 gm. more of clay was added to the soil in each pot.

At the beginning of the experiment the pots were saturated with a solution which furnished to each 0.105 gm. calcium oxid, 0.019 gm. magnesium oxid, 0.0046 gm. potassium oxid, and 0.0706 gm. nitric acid. No further fertilizing was necessary.

In these experiments the yield of beans seemed to increase as the proportion of soluble fertilizing constituents decreased, indicating that the form of plant food in the soil is not of so much importance to leguminous plants as it is to cereals, and that the former can readily utilize plant food not available to the latter.

From the yields and analyses of the crops the following table is calculated, showing the fertilizing constituents in soluble and insoluble forms applied and the amounts assimilated both by barley and beans with (*a*) soil mixture 1 and (*b*) soil mixture 2:

Fertilizing constituents applied to the soils and assimilated by barley and horse beans.

	1.		2.		3.		4.		5.	
	(*a*).	(*b*).	(*a*).	(*b*)	(*a*).	(*b*).	(*a*).	(*b*).	(*a*).	(*b*).
Nitrogen added—	*Gm.*	*Gm*	*Gm.*	*Gm.*	*Gm.*	*Gm*	*Gm*	*Gm*	*Gm.*	*Gm.*
In soluble form.	1 1200	1.1200	0 5600	0.5600	0 2800	0 2800	0.1120	0.1120	...	....
In insoluble form	.. ..	... .	0.5600	0 5600	0 8400	0.8400	1 0080	1 0080	1.1200	1.1200
Nitrogen removed—										
By barley.......	0.3539	0 3109	0.2020	0 2143	0 1832	0 2735	0.1588	0.1875	0.1714	0.1878
By beans	0.1725	0.3287	0.1442	0 3035	0.2892	0.4048	0.3350	0.2525	0 2158	0.2804
Phosphoric acid added—										
In soluble form..	3.0000	3.0000	1 5000	1.5000	0 7500	0 7500	0 3000	0.3000	... .	....
In insoluble form	... .	....	1.5000	1 5000	2.2500	2.2500	2.7000	2.7000	3.0000	3.0000
Phosphoric acid removed—										
By barley........	0.1312	0 1340	0.0583	0 0620	0.0549	0 0654	0 0401	0 0475	0.0301	0.0065
By beans	0.0475	0.0533	0.0307	0 0468	0.0648	0.0697	0 0624	0.0195	0.0402	0.0487
Potash added—										
In soluble form..	4.0000	4.0000	2.0000	2.0000	1 0000	1.0000	0.4000	0.4000	....	....
In insoluble form	....	... .	2.0000	2.0000	3 0000	3 0000	3.6000	3.6000	4.0000	4.0000
Potash removed—										
By barley........	0 6048	0.3908	0.3184	0.3677	0.3208	0.3162	0 1816	0.2007	0.1146	0.0120
By beans	0 2749	0.3510	0.1755	0.2711	0.1516	0 1969	0.1237	0.1576	0.1161	0.1127
Lime added—										
In soluble form..	2.2400	2.2400	1 1200	1.1200	0 5600	0.5600	0.2240	0.2240	....	....
In insoluble form	....	....	1 1200	1.1200	1.6800	1 6800	2.0060	2.0160	2.2400	2.2400
Lime removed—										
By barley........	0.1519	0.1656	0.1073	0.1290	0.0836	0.1241	0.0653	0.0687	0.0529	0.0212
By beans	0.1667	0.2084	0.1638	0.1823	0.2374	0.2385	0.2746	0.2343	0.2180	0.2346

It appears from the above results that leguminous plants (horse beans) do not make the same demands either upon the nitrogen or the other fertilizing constituents as cereals (barley), and that with like amounts of the other essential constituents lime influences the growth of leguminous plants more than potash.

The yield of beans depends upon the amount of combined nitrogen present in the soil, although this does not preclude the assimilation of a certain amount of the free nitrogen of the air by this plant.

Experiments with manures and artificial fertilizers, G. H. WHITCHER (*New Hampshire Sta. Bul. 21, pp. 16, pls. 1*).—This is principally a summary of results obtained while the station was located at Hanover, New Hampshire, and published in Bulletins 6 (E. S. R., 1, p. 127), 10 (E. S. R., 2, p. 412), and 12 (E. S. R., 2, p. 734), with the addition of data secured at Durham.

Subjects reported on are spring and fall applications of barnyard manure; how to apply manure; how much manure to use; substitutes for barnyard manure; relative efficiency of chemicals and barnyard manure; comparison of manufactured fertilizers, chemicals, and ashes; and directions for mixing and using fertilizers.

From the results of all experiments the following conclusions are drawn:

"Manure applied in the fall to the surface, either of plowed or grass land, will, by the action of frost and rain, become so thoroughly pulverized and distributed through the soil that it acts more quickly, and is in better condition for plants to assimilate, than the same manure would be if applied in the spring.

"The loss from evaporation and drainage (unless the surface is very steep) will probably be much less than the loss resulting from fermentation if the manure is allowed to accumulate in cellars or the washing if left in open yards.

"On most soils and for most crops surface application is better than plowing in, and especially if manure is applied in the fall, but in any case, except for manure that is so coarse that it can not be mixed with the soil by cultivation, it is a safe rule to keep the manure as near the surface as possible and to have it as thoroughly mixed with the seed bed as can be done. This carries with it the necessity of using only such bedding and absorbents as are of themselves fine or easily pulverized.

"For our common field crops—corn, oats, rye, barley, potatoes, etc.—it is not profitable to use more than from 15 to 20 cart loads (5 to 7 cords) of manure per acre.

"On an average, on New Hampshire soils and with general crops, $1 invested in the best prepared fertilizers has given an increase of crop valued at $2.34, while $1 invested in the chemicals (dissolved boneblack, muriate of potash, and sulphate of ammonia) has given an increase valued at $3.56, a difference of $1.22 in favor of, and due entirely to, the substitution of chemicals for prepared fertilizers at equal cost.

"This difference is due chiefly to the wrong proportions of plant food in the prepared fertilizers, and more to the deficiency of potash than any other cause.

	Per cent.
Prepared fertilizer used gave—	
Phosphoric acid	12.0
Potash	3.0
Nitrogen	3.0
While the chemicals that gave the best results contained—	
Phosphoric acid	8.6
Potash	14.6
Nitrogen	2.4

"Chemicals properly mixed and used can and do give as good returns as barnyard manure, and oftentimes better, and this in a 6 years' rotation.

"Leached ashes gave better results per dollar invested than whole ashes."

Researches on the potash and phosphoric acid required by cultivated plants, SMETS and SCHREIBER (*Rev. Agron. Louvain, 4*

(*1895*), *No. 1*, *pp. 78, 79*).—As a result of 267 pot experiments the relative requirements of different plants for potash and phosphoric acid are stated to be as follows:

For potash.		*For phosphoric acid.*	
Oats (native)	18	Lupines	27
Oats (Flanders)	23	Potatoes	50
Potatoes	37	Mustard	53
Spring wheat	43	Spring wheat	60
Flax	56	Oats (native)	64
Mustard	70	Flax	66
Turnips	80	Oats (Flanders)	73
		Turnips	85

Pot experiments with phosphates, F. W. MORSE (*New Hampshire Sta. Rpt. 1893, pp. 143–149*).

Synopsis.—Tests of neutral and alkaline ammonium citrate solutions and pot experiments with "redondite" (a phosphate of iron and alumina), a concentrated phosphate prepared from the "redondite," dissolved boneblack, ground bone. and basic slag on rye during 2 years (no additional fertilizers being applied the second year) are reported, which show that the concentrated phosphate compared favorably with the ground bone and basic slag, and that neutral ammonium citrate gave uniform results with the bone, slag, and concentrated phosphate.

Experiments to compare the fertilizing effects of "redondite" (a nearly pure phosphate of iron and alumina from the Island of Redonda), a concentrated phosphate prepared from the "redondite," dissolved boneblack, ground bone, and basic slag, and incidentally to test "the relative merits of neutral and alkaline solutions of ammonium citrate as solvents of reverted phosphates," were conducted as follows:

"Some pots made of sheet zinc were procured, which were 8½ in. in diameter and 9 in. deep. A hole was made in the side of a pot near the bottom; screened pebbles were put in to the depth of an inch; and a glass tube long enough to reach to the top was placed on the pebbles. This arrangement insured thorough drainage and circulation of air. Fine sand was selected for soil, and was moistened before it was put into the pots to prevent its packing too closely. As the sand was put into a pot, the fertilizing materials were added a little at a time, and a nearly uniform distribution of plant food secured. Spring rye was chosen as the most suitable plant with which to experiment. . . .

"The percentage of total phosphoric acid in each material, together with the percentages soluble in neutral and alkaline citrate solutions, were determined. . . .

"The pots were arranged in duplicate series of 9 pots each. To each pot was added 1 gm. of muriate of potash and 0.75 gm. of nitrate of soda, while the quantities of the different phosphates were varied. . . .

"The first 6 pots of each series were used for comparing equal quantities [3.25 gm.] of the phosphates with each other and with the phosphate naturally present in the sand. In the seventh and eighth pots the quantity of concentrated phosphate was reduced [to 1.25 gm.] and its action when alone compared with its action when mixed with a little soluble phosphate [0.75 gm.]. . . .

"Two crops were raised without changing the soil in the pots, one in 1891 and the other in 1892" [without further addition of fertilizers].

The following table shows average weights of straw and grain per plant in each series for the 2 years:

Yield of rye in experiments with different phosphates.

No of pot.	Kind of phosphate.	Weight of grain per plant.		Weight of straw per plant.	
		1891.	1892.	1891.	1892.
		Gm.	*Gm.*	*Gm.*	*Gm.*
1	None	0.0508	0 0532	0.1616	0.2144
2	Dissolved boneblack	.1161	.0899	.2615	.2244
3	Ground bone	.0750	.0794	.2268	.2624
4	Concentrated phosphate	.0677	.0549	.2238	.1914
5	Basic slag	.0741	.0536	.1934	.2382
6	Redondite	.1047	.0427	.2296	.1725
7	Concentrated phosphate	.1050	0757	.2520	.2390
8	Concentrated phosphate, dissolved boneblack	.1166	0527	.1834	.2232
9	Dissolved boneblack	.1503	.0631	.3687	.2360

"By inspecting the above table, it is seen that the pot containing bone increased its yield per plant, both of grain and straw, in the second year, which was also the case with the pot containing no phosphate. The slag increased the average weight of straw, while the grain was slightly decreased. The mixed phosphates in pot 8 also increased the straw, but the grain was decreased more than one-half. The largest decrease in both grain and straw is seen in the case of the dissolved boneblack in pot 9, which shows it to have been exhausted in the first year. The mixing of dissolved boneblack with the concentrated iron and aluminum phosphate was disadvantageous, since either did better when used alone, if both years' crops are reckoned together. . . .

"In conclusion, the results of the 2 years show that the concentrated iron and aluminum phosphate compared favorably with the ground bone and basic slag, and that the neutral ammonium citrate solution gave uniform results with the 3 forms of reverted phosphates. The natural phosphate, redondite, behaved unlike the concentrated phosphate produced from it, whether compared by its neutral or its alkaline available acid."

Further experiments in this line on a variety of soils are to be made.

Analyses and valuation of fertilizers (*Connecticut State Sta. Bul. 120, pp. 1-11*).—A schedule of trade values with notes on valuation of fertilizing ingredients for 1895, and analyses with comments on the character of the product of 43 samples of fertilizing materials, including nitrate of soda, dried fish, dried blood, cotton-seed meal, superphosphates, kainit, muriate of potash, wood ashes, and cotton-hull ashes.

"So-called 'available phosphoric acid' (*i. e.*, soluble and reverted taken together) costs at present 2½ to 3 cts. less per pound in 'dissolved rock phosphate' than in 'dissolved boneblack.' . . .

"Muriate of potash is the cheapest source of potash, which, in this form, costs from 4¼ to 4½ cts. per pound.

"Canada ashes are so variable and commonly so poor in quality that they can not serve economically as a source of potash. . . .

"Cotton-hull ashes, this spring, have been of good quality and furnish potash for 5¼ cts. a pound on the average."

Analyses of fertilizers and wood ashes, F. W. MORSE (*New Hampshire Sta. Bul. 26, pp. 10*).—Notes on the conduct of the fertilizer control in New Hampshire, regulations concerning analyses of fertilizers, text of the State fertilizer laws, and tabulated analyses of 54 samples of

fertilizers sold in New Hampshire in 1894, and of 6 samples of wood ashes:

"During the past year there have been reported 161 analyses of wood ashes by the New England experiment stations. By scanning and arranging these results some knowledge of the general quality of ashes used by our farmers may be obtained. The various figures have been grouped within different limits, in order to find out the most common composition rather than the average. The grouping of results is as follows:

"Twenty-three samples under 4 per cent of potash; 58 between 4 and 5 per cent; 38 between 5 and 6 per cent; 23 between 6 and 7 per cent; 19 over 7 per cent.

"Out of these 161 samples it may at once be seen that the most common percentages of potash were from 4 to 5, or from 80 to 100 lbs. of potash in 1 ton of ashes. A large majority of the samples contained between 1 and 2 per cent of phosphoric acid, or from 20 to 40 lbs. in 1 ton. These figures would yield, at the station valuations, a value of between \$5.20 and \$7.25 for the potash and phosphoric acid most commonly found in 1 ton of wood ashes.

"Among the above mentioned samples 31 were reported as 'Canada hard wood ashes.' These samples have been grouped by themselves within the same limits, as follows:

"Six samples under 4 per cent of potash; 15 samples between 4 and 5 per cent of potash; 3 samples between 5 and 6 per cent of potash; 4 samples between 6 and 7 per cent of potash; 3 samples over 7 per cent of potash.

"The variation in quantity of water in ashes was remarkable, ranging from less than 1 per cent to over 30 per cent. Seventeen samples showed over 20 per cent, or 400 lbs. of water in 1 ton. The most common amount was between 10 and 12 per cent, or from 200 to 240 lbs. per ton. One sample received at this station yielded over 500 lbs. of water per ton."

Fertilizers, commercial and domestic, B. B. Ross (*Alabama College Sta. Bul. 63, pp. 75–104*).—A popular bulletin designed "to furnish some practical information with regard to the methods of utilizing to the best advantage crude domestic manures, in conjunction with appropriate kinds and quantities of commercial fertilizers." The subjects treated are stimulant manures, including lime, gypsum, and salt; nutritive manures, including the various commercial fertilizers; domestic manures, including barnyard manure, muck, and marl; bat manure; composts, and green manures.

An improved apparatus for drying phosphates, marl, clay, sand, and other materials, D. W. Anderson and G. W. Parsons (*Jour. Soc. Chem. Ind., 14 (1895), No. 5, p. 468.*)—A patented process.

Reduction of Thomas slag, E. Meyer (*Ztschr. angew. Chem., 1895, No. 11, p. 322*).—A patented process in which it is proposed to increase the action of the alkali silicates on the liquid slag by mixing with the silicate a certain amount of reducing material, such as coke dust, pyrites, or sulphid of sodium.

The manufacture of superphosphates, G. Gastine (*Prog. Agr. et Vit., 12 (1895), No. 14, pp. 358–365*).

A study of the agricultural value of the phosphate of alumina of Grand Connétable, A. Andouard (*Bul. Sta. Agron. Loire-Inférieure, 1893–'94, pp. 62–74*).—A detailed account of experiments briefly reported in *Compt. Rend., 120 (1895), No. 6, pp. 337–339* (E. S. R., 6, p. 798).

Comparative tests of slag and superphosphate on the same soil, G. Battanchon (*Prog. Agr. et Vit., 12 (1895), No. 19, pp. 505–507*).

Experiments with various phosphates at Borsbèke-lez-Alost, Belgium, P. de Vuyst (*Rev. Agron. Louvain, 4 (1895), No. 1, pp. 28–35*).—Already noted in *L'Engrais, 10 (1895), No. 20, pp. 468–470* (E. S. R., 7, p. 24).

Refuse leather material in fertilizers, M. S. McDowell (*Agl. Sci., 8 (1894), No. 12, p. 573*).

Federal legislation relating to the trade in fertilizers and similar materials in Switzerland, E. CHUARD (*Chron. Agr. Cant. Vaud, 8 (1895), No. 11, pp. 282-287*).

The sampling of dung and the probable error in the determination of nitrogen, W. S. SWEETSER (*Agl. Sci., 8 (1894), No. 12, pp. 572, 573*).

The world's consumption of fertilizers—oil cakes, MAZIÈRES (*L'Engrais, 10 (1895), No. 17, pp. 359, 360*).—It is stated that France consumed in 1894 for feeding and fertilizing purposes 620,000 tons of oil cake of various kinds.

Griqualand West nitrate fields (*Agl. Jour. Cape Colony, 8 (1895), No. 9, pp. 220, 221*).

The Augias stall and the most profitable protection of manure, E. HILDEBRANDT (*Fühling's landw. Ztg., 44 (1895), No. 11, pp. 345-350*).

Investigations on the foraging powers of some agricultural plants for phosphoric acid, W. BALENTINE (*Maine Sta. Bul. 16, 2d ser., pp. 4*).—Reprinted from the Annual Report of the station for 1893, p. 13 (E. S. R., 6, p. 709).

Experiments with manures and artificial fertilizers, G. H. WHITCHER (*New Hampshire Sta. Rpt. 1893, pp. 179-192*).—A reprint of Bulletin 21 of the station (E. S. R., 7, p. 107).

A discussion of certain commercial articles, W. H. JORDAN (*Maine Sta. Bul. 19, 2d ser., pp. 4*).—This circular cautions farmers against companies and agents selling questionable goods in general and calls attention especially to a fertilizer put on the market by the Chemical Compound Fertilizer Company, otherwise Mason, Chapin & Co., of Providence, Rhode Island, accompanied by "claims that can not be justified by existing knowledge and at a price greatly out of proportion to the real value of the article." Examinations of this fertilizer by the Connecticut and Maine stations indicate that it is a mixture of nitrate of soda, some crude ground phosphate, and probably soda ash, worth about $30. The price demanded for this article in Connecticut was $50, in Maine $55 per ton.

Fertilizing materials, F. W. MORSE (*New Hampshire Sta. Rpt. 1893, pp. 132, 133, 137*).—Analyses of 34 samples of fertilizing materials, including home-mixed fertilizers, wood ashes, muck, bone scrap from knife factory, cotton waste from paper mills, dustings from paper mills, silk rags, woolen rags, ground bone, dissolved boneblack, dried blood, beef scrap, desiccated fish, muriate of potash, sulphate of ammonia, and nitrate of soda.

Commercial fertilizers and chemicals, R. T. NESBIT and G. F. PAYNE (*Georgia Dept. Agr. Bul. 30, pp. 30*).—Notes on valuation, a table of average composition of the ordinary fertilizing materials, and tabulated analyses of 219 samples of fertilizing materials, including mixed fertilizers, cotton-seed meal, superphosphates, bone, and kainit.

Inspection of fertilizers in Maine, W. H. JORDAN, J. M. BARTLETT, and L. H. MERRILL (*Maine Sta. Bul. 18, 2d ser., pp. 15*).—A brief synopsis of the requirements of the State fertilizer law, notes on valuation, a list of manufacturers complying with the law in 1895, and tabulated analyses of 144 samples of fertilizer examined during 1895.

Fertilizer inspection in New York (*New York State Sta. Bul. 85, pp. 36-64*).—A schedule of trade values of fertilizing materials, text of the State fertilizer laws, and tabulated analyses and valuations of 162 samples of fertilizers examined during the fall of 1894.

Fertilizer analyses of the North Carolina fertilizer control, H. B. BATTLE (*North Carolina Sta. Bul. 111, pp. 25*).—An outline of the work of the fertilizer control station, a digest of the State fertilizer laws, a statement of the conditions under which analyses of fertilizers are made for farmers, suggestions as to sampling, explanation of terms used in reporting analyses, notes on valuation, a schedule of freight rates from the seaboard to inland points, and tabulated analyses and valuations of 266 samples of fertilizers examined during 1894.

Fertilizer analyses of the North Carolina fertilizer control, H. B. BATTLE (*North Carolina Sta. Special Buls. 26, pp. 18; 27, pp. 3*).—A digest of the State fertilizer laws, explanations of terms used in reporting analyses, notes on valuation, freight rates from the seaboard to inland points, and tabulated analyses and valuations of 235 samples of fertilizers examined during 1895.

Fertilizer inspection in Vermont, J. L. HILLS and B. O. WHITE (*Vermont Sta. Bul. 46, pp. 12*).—This includes statements regarding collection of samples, text of the State fertilizer laws, lists of licensed fertilizers sampled by the station, and tabulated analyses and valuations of 33 samples of fertilizers.

Fertilizer analyses and valuations, J. A. MYERS (*West Virginia Sta. Special Bul., Dec., 1894, p. 1*).—Suggestions regarding the purchase of fertilizers and tabulated analyses and valuations of 147 samples of fertilizing materials, including mixed fertilizers, superphosphates, bones, kainit, and salt examined during 1894.

FIELD CROPS.

Field experiments with corn, W. C. LATTA (*Indiana Sta. Bul. 55, pp. 24–41*).

Synopsis.—These experiments embrace tests of time of planting, length of period of growth for corn planted at different dates, thickness of planting, depth of plowing, depth of cultivation, rotation, residual effects of stable manure, effect of commercial fertilizers, variety tests, and tests of implements used in cultivation of corn. Taking in most cases the averages for a number of years, the results favor planting not later than May 10, a distance of from 11 to 14 in. in the drill, plowing at least 8 in. deep, cultivating 2 in. deep, and rotative cropping. There was a notable residual effect of stable manure in the eleventh crop after manure was applied, and a financial loss from the use of commercial fertilizers. Corn planted late matured in a shorter time than when planted early.

Most of these experiments are in continuation of the work of previous years reported in Bulletin 50 of the station (E. S. R., 6, p. 134). In 1894, as in the preceding year, the yields were low on account of drought.

Time of planting (pp. 24, 25).—The average results of planting at different dates were as follows: May 1, 40.97 bu. per acre; May 8 to 11, 40.39 bu.; May 15 to 16, 29.82 bu.; May 21 to 22, 37.25 bu.; and May 28 to 30, 31.67 bu.

Length of period of growth (pp. 25, 26).—The average results for 3 varieties tested during 3 years were as follows: When planted May 6, 125 days elapsed between planting and maturity; planted May 16, 120 days; May 26 to 27, 114 days; June 4 to 6, 111 days; and June 14 to 16, 104 days. Taking the average of all dates of planting for the 3 years, the variety Purdue Yellow had a growing period of 108 days, Riley Favorite 113 days, and Yellow Nonesuch 116 days.

Thickness of planting (p. 26).—In the dry season of 1894, as in the similar season of 1893, every increase in the distance between plants from 11 to 19½ in. was followed by an increase in yield of corn. However, taking the average results for 9 years distances of 11, 12, and 14 in. between stalks afforded larger yields of grain than thinner planting. In both favorable and unfavorable seasons thick planting gave the largest yield of stover.

Depth of plowing (pp. 26, 27).—On land plowed from 4 to 16 in. deep the average yields for 4 years varied but little as the result of different depths of preparation, the slight difference being in favor of a depth of 8 in.

Depth of cultivation (pp. 27, 28).—The average yield of corn for 4 years on plats cultivated 1 in. deep was 39.60 bu. per acre, 2 in. deep 40.07 bu., and 3 in. deep 38.73 bu.

Rotation (pp. 28, 29).—The following table gives the yield of corn when grown in rotation and when cultivated continuously:

Yield of corn per acre from rotation and successive cropping.

	1894.	Average, 7 years.
	Bushels.	*Bushels.*
Crops grown in rotation	33.28	32.17
Grain crops only grown	22.61	26.77
Gain from rotation	10.67	5.40

The gain from rotation in 1894 is almost twice the average gain for the 7 years, showing that the difference in favor of rotation is increasing.

Residual effect of stable manure (p. 29).—About 30 tons of stable manure was applied during 1883 and 1884 to land which has since been continuously devoted to corn culture. In every year since the application of the manure the manured plats have given a larger yield than unfertilized check plats, the average annual increase being 9.94 bu. per acre, the total increase for the 12 years, 119.33 bu. In 1894 the difference in favor of the plat manured 11 and 12 years before was 4.7 bu.

Effect of fertilizers (pp. 29–31).—In the dry season of 1894 an actual decrease in yield followed the use of complete commercial fertilizers, and the increase in yield when barnyard manure was used was only 0.48 and 1.18 bu. of corn per acre.

Varieties (pp. 31–33, 36–41).—As the result of experiments at the station extending over 3 years the author concludes that the varieties which yield most grain produce less stalks and that early maturing varieties yield a larger proportion of grain to stalks than the later kinds.

Coöperative variety tests were conducted in 4 counties and the tabulated results are interpreted by the author as indicating the undesirability of getting seed corn from remote localities.

Tests of cultural implements for corn (pp. 33–35).—Tabulated data and explanatory notes give the results of using the following cultivators: Spring tooth, disk, Hoosier, Tower, corn plow, 1-horse cultivator, and weeder. The results indicated an advantage in cultivating in 2 directions corn planted in hills.

Field experiments with corn, W. M. HAYS (*Minnesota Sta. Bul. 40, pp. 233–237, 245–254*).—The yield of corn and stover is tabulated for 38 varieties. Hoag Yellow Dent, Lamb Yellow Dent, Allyn Yellow

Dent, and St. Paul Yellow Dent "are proving superior varieties [for grain], having yielded well through a series of years."

"The large sweet varieties seem especially well suited to grow for silage and for fodder where a large yield only of coarse forage is desired. Where corn is grown for ears, however, the dent varieties are the best we have found. . . .

"For the central third of the State some of the very earliest dent varieties of corn are suitable for growing on good arable lands in rotation with small cereals. But the larger and medium-sized flint varieties will, as a rule, be quite as profitable in this section. . . .

"For the northern third of Minnesota small, early maturing flint and sweet varieties of corn give the best results for fodder, and even for grain."

When corn roots were severely root pruned the yields were less than on the untreated plats, the differences in the 3 years of the test being $13\frac{1}{2}$, $2\frac{1}{3}$, and $1\frac{5}{8}$ bu. per acre. The greatest decrease occurred when the ground was dry at the time of root pruning. Cultivation to a depth of 2 or 3 in. is recommended for corn. When corn was listed the yield was less than when planted in the ordinary manner.

Hilling corn at the last cultivation with a hoe exerted no marked influence on the yield of grain. When the aërial or brace roots were cut during cultivation the yield of corn was greater than on the untreated plat.

Notes and tabulated data give the yields of corn when tilled with 5 different cultivators.

"As compared with the ordinary corn cultivator, having 2 shovels on a side, . . . we have cultivators which do not so seriously prune the roots, but do cultivate the corn quite as well."

The article contains notes on methods of cultivating corn and directions for selecting seed corn.

Field experiments with corn, R. H. MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 33, pp. 129–131*).—These consisted of a test of a complete fertilizer; of narrow *vs.* wide rows, in which narrow rows afforded the larger yield; cultivating to a depth of 3 in. *vs.* 7 in., in which there was a slight gain with the shallower depth; frequent and infrequent cultivation, in which frequent cultivation proved unprofitable; drilled *vs.* checked corn, in which the larger yield was made by drilled corn; and a comparison of manure from a well balanced and from a poorly balanced ration, the results favoring that from a balanced ration.

Field experiments with corn, J. H. CONNELL and J. CLAYTON (*Texas Sta. Bul. 34, pp. 541–551, 562–571*).—Fifty-eight varieties were tested at the substation at McKinney in 1894, but the unusual hot winds July 1 reduced the yield of the medium and late maturing varieties and thus vitiated the results. Of 42 varieties grown at Wichita Falls the largest yield was made by Extra Early Huron. Tabulated data and descriptive notes give the yield and characteristics of varieties tested at the 2 substations and of 61 varieties grown in 1894 on the station farm.

On the black land of the McKinney Substation sulphate of ammonia, bat guano, ashes of guano, kainit, superphosphate, stable manure, cotton-seed meal, nitrate of soda, boneblack, and gypsum were applied singly, and each resulted in a financial loss, the largest increase over the yield of the unfertilized plat following the use of 400 lbs. of acid phosphate per acre, but this increase was not equal in value to the cost of the fertilizer.

On a farm near the station the following fertilizers applied singly increased the yield more than 5 bu. per acre: Acid phosphate, bat guano, rotted stable manure, and cotton-hull ashes. Of 10 fertilizers or manures applied singly only rotted stable manure at the rate of 2 tons per acre afforded a profit.

At McKinney the yield on the subsoiled plats was about 3 bu. per acre greater than that on the untreated plats, an amount not sufficient to repay the cost of subsoiling. The differences in yield were very slight between rows $3\frac{1}{2}$ and 4 ft. wide and between single and double beds, or ridges.

Field experiments with cotton, J. H. CONNELL and J. CLAYTON (*Texas Sta. Bul. 34, pp. 551-555, 571-582*).—On black, waxy, upland soil at the McKinney Substation a number of fertilizing materials were employed separately. With stable manure, nitrate of soda, boneblack, acid phoshate, and cotton-hull ashes the yield was sufficiently increased to afford a slight profit. The largest increase, 290 lbs. of seed cotton per acre over the yield of the unfertilized plat, followed the use of 500 lbs. per acre of boneblack.

In a test of methods of preparing the land for cotton, conducted on a deep soil at McKinney, the plats subsoiled to a depth of 9 in. afforded the largest yields, the increase in the crop of the first year being more than sufficient to cover the cost of subsoiling; however, no increase occurred when the subsoiler was used only under the drill or in the water furrow. Changing the form or size of the bed (ridge) did not materially affect the yield.

The variety test at McKinney was vitiated by injuries inflicted by the bollworm. The long staple varieties suffered least. Tabulated data and descriptive notes give the results of a test of 31 varieties made at the station. When cotton was planted April 10 the best financial returns were made by the Drake Cluster, Wellborn Pet, and Cochran Prolific varieties; when the date of planting was May 10 the greatest profit was afforded by Herlong, Drake Cluster, and Cochran Prolific.

Grasses and forage plants, J. H. CONNELL and J. CLAYTON (*Texas Sta. Bul. 34, pp. 555-560, 585-592*).—Descriptive notes on 22 species of grasses and forage plants grown at McKinney and Wichita Falls in 1894 and on 22 species seeded in spring on the station farm and on 29 sown in the fall. Among the most promising of the forage plants for all 3 localities were alfalfa, *Melilotus alba*, and perennial rye grass.

Other promising forage plants at McKinney were water meadow grass (*Glyceria aquatica*) and Texas blue grass, and at the station alsike clover, meadow fescue (which is classed by the authors as the best of the true grasses tested), tall oat grass, redtop, *Lespedeza striata*, Colorado bottom grass, and awnless brome grass. The propagation of Bermuda grass from seed gave satisfactory results. Dwarf Essex rape made a satisfactory growth both at McKinney and at the station. Sacaline sown February 15 made but slight growth during the first season, the stalks being not more than 10 in. long.

Experiments with oats, barley, and spring wheat, W. SAUNDERS (*Canada Central Exptl. Farm Bul. 21, pp. 12*).—These tests of the best time for sowing the small grains were conducted for several years at Ottawa and at the substations at Nappan, Nova Scotia; Brandon, Manitoba; Indian Head, Northwest Territories; and at Agassiz, British Columbia. Oats, barley, and wheat were sown at 6 different dates at intervals of a week. Several varieties of each grain were sown, and incidentally the varieties were compared.

At Ottawa the earliest sowing, which was made in most years about April 20, afforded the largest yield with all grains, and the yield decreased as the date of sowing was later. At Nappan, where the test began somewhat later, the first 3 sowings gave results almost identical; with sowings subsequent to the third the yield decreased considerably.

At Brandon, where the first sowing was usually made during the first few days of May, there was no material decline in yield of either wheat or oats until the last 2 sowings. The author recommends, however, that in the vicinity of Brandon all wheat and oats be sown by May 20 to 25, and all barley by June 1.

At Indian Head, the first sowing, generally made April 18 to 24, yielded least, and this was true with oats, barley, and wheat; seeding as late as May 15 to 25 afforded satisfactory yields. At Agassiz, where the dates of first sowing were April 12 to 24, the results favored late sowing.

The average yield of 2 rowed barley in 129 tests was 32 bu. 35 lbs. per acre; the average yield of 6 rowed barley in 83 tests was 31 bu. 22 lbs.

In 231 tests oats averaged 47 bu. 25 lbs. per acre, in 212 tests barley averaged 32 bu. 17 lbs., and in 220 tests spring wheat averaged 21 bu. 38 lbs. per acre. The Banner variety of oats yielded on an average 10 bu. 13 lbs. per acre more than did the Prize Cluster.

Field experiments with oats and mixed crops (*Minnesota Sta. Bul. 40, pp. 275–282*).—On land which had been in corn the previous year, the yield of oats when cultivated in without plowing was 82½ bu. per acre; when sowed after spring plowing and harrowed in, 79⅛ bu.; when sowed and plowed in 3 or 4 in. deep and afterwards harrowed, 84⅜ bu. Oats which had not been rolled yielded more both of grain and of straw than oats rolled when 8 in. high or when 12 in. high.

Oats alone yielded a larger amount of hay than mixtures of oats and peas, flax and millet, and flax and peas, and also more than peas alone. The results of a test of oats and wheat alone and mixed in various proportions are tabulated. Oats were sown at the rate of 6, 7, 8, 9, 10, and 11 pecks per acre April 25 and again 12 days later. Eight pecks afforded the largest yield of grain, 46.8 bu., in the earlier sowing, and 9 pecks the largest yield, 45.1 bu., at the later sowing. The average yield for all amounts of seed was for the sowing of April 25, 39.4 bu. per acre, and for the sowing of May 7, 38.3 bu.

The yields of wheat and oats obtained when a broadcast seeder and several patterns of grain drills were used are tabulated and discussed. "Broadcasting seems to be as good a plan of seeding as any when there is an abundance of moisture in the surface of the soil."

Experiments with oats, W. C. LATTA (*Indiana Sta. Bul. 55, pp. 42-45*).—Of the varieties tested in 1894, Improved White Russian afforded the largest yield, 67.60 bu. per acre. In an experiment on thickness of seeding 4, 5, 6, 7, 8, 9, 10, 11, and 12 pecks of seed per acre were sown with a drill. Eight to 12 pecks per acre afforded larger yields than smaller amounts of seed. The results of a fertilizer experiment are tabulated, stable manure affording a larger yield and at less cost than commercial fertilizers.

Peanuts, C. L. NEWMAN (*Arkansas Sta. Bul. 31, pp. 121-126*).—At Camden the Spanish peanut yielded more than 50 bu. per acre on soil which produced only 5 bu. of Whippoorwill cowpeas. All other varieties of peanuts tested failed completely.

Spanish peanuts planted July 19 and harvested October 30 afforded a crop of which nine tenths was mature.

When the distance between plants was 12 by 4 in. the yield was 143½ bu. per acre, 12 by 12 in. 102 bu., and 12 by 24 in. 91 bu.

Upland, which with 200 lbs. of cotton-seed meal per acre yielded 10 bu. of corn, gave without fertilizers a yield of 58 bu. of peanuts.

Experiments with sugar beets, H. A. HUSTON (*Indiana Sta. Bul. 55, pp. 46-54*).—Among the varieties tested Vilmorin afforded the highest sugar content and purity coëfficient, but the lowest yield. A bacterial disease badly affected from 2 to 11 per cent of the beets examined at the station. The effect of the disease was to reduce the sugar content and the purity of the juice.

Smooth beets contained 12.2 per cent of sugar in the juice, scabby beets 12 per cent; the purity coëfficient of smooth beets was 84.7, of scabby beets 84.5.

The average yield of beets thinned to a distance of 8 in. in the row was 18.69 tons per acre, thinned to 4 in. 19.49 tons, the distance between rows in each case being 18 in. When beets were loosened before harvest a slight improvement in the quality of the juice was noted.

Experiments indicated no inferiority of American beet seed as compared with foreign-grown seed. The cost of growing and harvesting an acre of beets on the station farm was $43.97. The results of analyses of 68 samples grown in different localities are tabulated.

Tobacco, A. J. BONDURANT (*Alabama College Sta. Bul. 64, pp. 107–155, figs. 21*).—This is largely a reprint from Bulletin 44 of the station (E. S. R., 5, p. 47). Methods of growing the plants and curing the crop are described and statements as to the cost of having the crop manufactured into chewing tobacco and cigars are given. In a test of 11 varieties the largest yield, 1,304.6 lbs. of cured tobacco per acre, was made by Havana Seed Leaf.

From the results of a special nitrogen experiment, the author concluded that nitric nitrogen contained in nitrate of soda gave the best results, organic nitrogen in dried blood the next best, and ammonia in sulphate of ammonia the poorest results. However, as the 3 nitrogenous fertilizers were not applied to the same variety of tobacco, no conclusions seem warranted.

A study of the burning quality of tobacco, V. VEDRÖDI (*Landw. Vers. Stat., 15 (1895), No. 3 and 4, pp. 295–310*).—To one plat was applied sulphate of potash at the rate of 560 lbs. per acre, to another the same quantity of carbonate of potash, and to a third no fertilizer. Stable manure was used on all plats in the preceding fall. To avoid the loss of nicotine and other substances, the samples of leaves for analysis were dried at a temperature of only 50° to 60° C. The more mature the leaves on the same plant the greater was the ash content. The fertilizers were apparently without influence on the percentage of total ash. The chlorin was least when carbonate of potash was used. The fertilizers did not increase the percentage of potash in the leaves. The tobacco with best burning quality was produced on the plat receiving carbonate of potash, the next best on the plat fertilized with sulphate of potash. The leaves from different parts of the plant varied greatly in burning quality; the bottom leaves had the highest ash content and burned best.

Wheat, W. M. HAYS (*Minnesota Sta. Bul. 40, pp. 254–270*).—In experiments extending over several years about 200 varieties were tested Owing to the loss of certain records by fire, the names of some of the bes varieties grown in 4, 5, and 6-year tests were lost. Of the varieties grown in only 3-year tests the largest average yields were made by Snowball, Rio Grande, and Bolton Blue Stem.

"For the present, south of the Northern Pacific Railway and in sections north of that line where early frosts do not usually kill late wheat, or on light quick lands, our farmers should use mainly blue stem for seed. Farther north it is better to sow Fife wholly or partly as it matures early. Where Blue Stem will ripen it will yield more wheat on the average, and, though it sells for a slightly lower price than Fife, it yields more money per acre. Owing to the looseness of its chaff, Blue Stem is not so well adapted to stand long after it is ripe as is Fife, and on the large farms this is sometimes a disadvantage, as the crop can not always be cut just when ripe. Care

in shocking and stacking is also more important with Blue Stem, as the loose chaff causes it to shell very readily."

Artificial crossing of varieties and selection of seed are discussed at length. The method used by the author in crossing varieties of wheat is as follows:

"All the upper part of the spike is cut away; also a few of the spikelets at the base of the spike. The middle smaller flower of each spikelet is pulled out, thus leaving the strongest pair of flowers on each of 6 or more spikelets, or in all 12 to 20 flowers on each spike or head. The anthers are then removed from these flowers and transferred inside the glumes of the other plant from which the stamens have been removed. All flowers which are so ripe that the anthers have opened are discarded and removed. The spike or head of wheat which has been treated or 'handled' is then wrapped with a piece of paper the size of ordinary toilet paper, which is tied with a string above and below the head. As a rule, only 6 to 10 per cent of the flowers thus pollenized produce kernels."

In selecting seed wheat grading by means of Strowbridge's broadcast seeder, arranged in the barn to run by hand, was found to be more satisfactory than the use of the screen. The wheat falling from the hopper on the revolving fans was thrown out, the heaviest grains being thrown farthest.

Field experiments with wheat, J. H. CONNELL and J. CLAYTON (*Texas Sta. Bul. 31, pp. 525–541*).—These consisted of tests of varieties and of fertilizers made at the substations at McKinney and Wichita Falls. Of 215 varieties of wheat grown at McKinney in 1894 the largest yields were made by Missouri Blue Stem, Penquite Velvet Chaff, Scott, Valley, Lebanon, and Bissell. Of the 230 varieties tested at Wichita Falls the largest yields were made by Strayer Longberry, Hybrid No. 9, and Rio Grande.

At both substations the following fertilizers were applied singly: Cotton-seed meal, sulphate of ammonia, nitrate of soda, rotted stable manure, fresh stable manure, green cotton seed, kainit, cotton-hull ashes, unleached ashes, superphosphate, raw bone meal, gypsum, salt, wheat straw, and bat guano. At McKinney the only manures affording a large increase in the yield of grain were sulphate of ammonia and nitrate of soda, and the use of every commercial fertilizer resulted in a financial loss. At Wichita Falls with the use of stable manure the increased yield of grain over the unfertilized plats was greater than with any of the commercial fertilizers. Of all the materials applied stable manure alone afforded a profit.

Time and depth of sowing wheat, oats, barley, and flax (*Minnesota Sta. Bul. 40, pp. 282–284*).—The depths of planting were $\frac{3}{4}$, $1\frac{1}{2}$, $2\frac{1}{2}$, and $3\frac{1}{2}$ in., and the dates of sowing April 27 and May 7. The soil was a rich open clay, fall plowed, and fairly compact, but in fine tilth. The best yields of grain were obtained by planting wheat and barley each $3\frac{1}{2}$ in. deep, oats $1\frac{1}{2}$ to $2\frac{1}{2}$ in., and flax $\frac{3}{4}$ in. deep. The largest yield of straw resulted from planting wheat, barley, and flax each $\frac{3}{4}$ in. deep, and oats $1\frac{1}{2}$ in. deep. With wheat, oats, and flax the earlier seeding

proved decidedly the better; for barley the difference was very slightly in favor of early planting.

Report of the Divide Substation, J. H. McClelland (*Colorado Sta. Rpt. 1891, pp. 71-78*).—Variety tests of oats, buckwheat, corn, and potatoes, and tests of depth of planting, depth of preparation, and date of planting potatoes. No conclusions are drawn as to depth of planting and preparation and date of planting. Detailed results of the experiments in cutting potatoes are not given. The forage plants that proved hardiest during the past season were timothy, red clover, alsike clover, tall meadow oat grass, Italian rye grass, large canary grass, and *Bromus inermis;* the last yielded 3,733 lbs. of dry hay per acre. A list of the forest and fruit trees planted and of the vegetables grown is given.

Report of the San Luis Valley Substation, C. A. Duncan (*Colorado Sta. Rpt. 1891, pp. 79-88*).—Variety tests of wheat, oats, peas, and potatoes, and culture experiments with alfalfa. Alfalfa seeded alone yielded better than when sown with wheat or oats; varying the amount of alfalfa seed between 15 and 20 lbs. per acre apparently exercised but little influence on the yield. On fall plowed land a better stand was obtained than on spring plowed land, but on the latter a more vigorous growth was made. Orchard grass sown with alfalfa was killed by drought, though the alfalfa survived. Better results were secured when alfalfa was sown May 1 than when the date was April 1, June 1, July 1, August 1, or September 1. With the exception of a few plants of orchard grass and *Bromus inermis*, all grasses not irrigated died. Other plants grown were sorghum, squash, muskmelons, watermelons, pumpkins, tomatoes, and cabbages.

Report of the Arkansas Valley Substation, F. A. Huntley (*Colorado Sta. Rpt. 1891, pp. 89-106*).—Variety tests with wheat, oats, barley, buckwheat, sugar beets, and potatoes were conducted. Other crops grown were rye, corn, sweet corn, pop corn, alfalfa, hemp, Kaffir corn, Jerusalem corn, millo maize, broom corn, soja beans, Canada field peas, and hairy vetch.

Of 8 grasses tested for 3 years only *Bromus inermis* and orchard grass gave "promise of enduring field culture for pasture." Kaffir corn, Jerusalem corn, and millo maize yielded well; soja beans did not mature seed. A field of 55 acres of alfalfa afforded in 3 cuttings an estimated yield of 395¼ tons, which, valued at \$3.50 per ton, amounts to \$1,383.37. The total cost for men and teams in harvesting the 3 crops was \$323.72, leaving a balance of \$1,059.65.

On the plat receiving the ashes resulting from the burning of coarse manure the yield of potatoes was less than on the plat to which was applied manure in the ordinary condition.

A method of estimating the weight of alfalfa hay in the stack and brief general notes on several injurious insects are given.

Report of agriculturist, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1893, pp. 9–13*).—Brief reference is made to fertilizer experiments with grass, oats, potatoes, and corn; and to hill *vs.* drill culture for corn; to white mustard and crimson clover as catch crops; to *Panicum crus-galli* and *P. miliaceum*, and to varieties of soja beans. The appearance of tubercles on the roots of some varieties of soja beans and not on others was noted. Seed of Canada peas was cheaply grown, but the results of an attempt to grow seed of vetches were unsatisfactory. In fertilizer experiments on meadows it was noted that clovers grew well wherever potash was applied. Potash and stable manure applied to corn afforded a larger profit than did stable manure applied alone, but in greater quantity. The yield of potatoes was greater with sulphate of potash than with muriate of potash, and the fertilizers gave better returns when drilled than when applied broadcast.

Variety tests of barley, flax, field peas, and millet, W. M. HAYS (*Minnesota Sta. Bul. 40, pp. 271–275*).—Of the varieties of barley the largest yields were made by Odessa, Mansbury, Black, Bernard, Black Hulless, Success, and Improved Black, in the order named. The author regards American flaxseed as equal in value for seed purposes to Russian seed. Fargo flax afforded the largest average yield of seed, 10 bu. per acre. Of 31 varieties of peas the largest yield in 1894, 9.7 bu. per acre, was made by Canadian Beauty. Of 7 varieties of millet tested Hungarian grass afforded the largest yield of hay, 1,820 lbs. per acre.

Experiments with barley, wheat, and meadows, M. J. R. DUNSTAN (*Rpt. Expts. on Agr. 1894, Notts. County (England), pp. 12*).—These consisted of variety tests of barley and wheat and of a fertilizer experiment on meadows. The varieties of barley affording the largest yields were Beardless, Archer, Lincolnshire Longear, and Goldthorpe. Those of highest quality were Hallett Chevalier, Webb Chevalier, and Golden Grain.

Important facts about corn, W. H. JORDAN (*Maine Sta. Bul. 17, pp. 4*).—This bulletin is condensed from the Annual Report of the station for 1893 (E. S. R., 6, pp. 716, 743).

Varieties of cowpeas, J. H. CONNELL (*Texas Sta. Bul. 34, pp. 582–584*).—Tabulated data and descriptive notes give the result of a test of 28 varieties of cowpeas. The largest yields of peas were made by the varieties Black Mush or Rice, Coffee, Green Colored, Red Crowder, and Large Red, all of these making more than 18 bu. per acre. The Pearson bean, a sword bean or horse bean, yielded 35 bu. per acre.

Fiber culture in Texas, F. FREMI REY (*Texas Farm and Ranch, 1895, June 22, p. 3*).

Report of the Trautenau (Austria) station for the culture and preparation of flax (*Flachs und Leinen, 2 (1895), No. 18, p. 216*).—This is a brief notice of the report mentioning the lines of work and the general character of the equipment of the station.

Forage plants, C. L. NEWMAN (*Arkansas Sta. Bul. 34, pp. 126–128*).—The yields afforded by the following plants are tabulated: Early Amber and Rural Branching sorghum, yellow millo maize, pearl millet, Jerusalem corn, Kaffir corn, Red Kaffir corn, teosinte, soja bean, Indian corn, sugar beet, Jerusalem artichoke, broom corn, sweet potato, Spanish peanut, pumpkin, and Kansas stock melon. The yield of Kansas stock melons was at the rate of 41,516 lbs. per acre. "The melons were fed to hogs, mules, and cows, but only the latter ate them with much relish."

On the treatment of fields of winter grain injured by cold, SIELDER (*Wochenschr. pom. ökon. Ges., 25 (1895), No. 9, pp. 102, 103*).—A popular article.

The profit of grain growing in Canada, B. ROTHNAGEL (*Ztschr. landw. Cent. Ver. Sachsen, 1895, No. 5, pp. 165–169*).

Grass seeds and plants (*Tennessee Sta. Bul., Vol. VII, No. 4, pp. 174-176*).—Brief reference is made to a garden of perennial grasses at the station. The seeds of Tennessee fescue (*Festuca rubra* var. *glaucescens*), Texas blue grass, and English blue grass were sent to a number of correspondents, but there were few reports of success. However, propagation of these grasses and of Bermuda grass by roots was generally successful. Directions are given for mailing diseased plants, insects, and scions intended for the station.

Fertilizer experiments with oats and wheat in Cape Colony, R. MARLOTH (*Agl. Jour. Cape Colony, 8 (1895), No. 10, pp. 239-241, figs. 2*).

Variety tests of potatoes. S. B. GREEN (*Minnesota Sta. Bul. 39, pp. 203-208, fig. 1*).—Descriptive notes and tabulated data give the yield and characteristics of 29 varieties tested on the station farm and at Bethel, Anoka County. On account of drought the early varieties made the largest yield of marketable potatoes. The tubers of each variety are figured.

Potato culture, TANCRÉ (*Fühling's landw. Ztg., 44 (1895), No. 10, pp. 308-315*).—A popular article dealing especially with the choice of seed according to size and starch content and with manuring.

Experiments on the proper fertilizers and on the choice of seed in the culture of sugar beets, E. MARRE (*Prog. Agr. et Vit., 12 (1895), No. 22, pp. 580-585*).

Practical sugar beet culture, H. BRIEM (*Der praktische Rubenbau. Wien: Wilhelm Frick, 1895*).

Names of field crops grown in the Central Provinces, India (*Agl. Ledger Series, Cent. Prov., No. 1, pp. 37*).—The botanical, the English, and the local names of each plant are given.

Rotation of crops and field management (*Minnesota Sta. Bul. 40, pp. 284-288*).—The plan of rotation experiments begun at the station in 1891 is outlined. In one field the rotation experiment occupies 41 plats, in another field 72 plats.

Report of the agricultural section, W. W. COOKE (*Colorado Sta. Rpt. 1894, pp. 42-45*).—Brief mention of the lines of experimental work in progress. Reference is made to an experiment in feeding corn and wheat to hogs in which the results favored the use of corn.

Report of the Rain Belt Substation, J. B. ROBERTSON (*Colorado Sta. Rpt. 1894, pp. 70-73*).—The crops grown at this station in 1894 were wheat, oats, barley, flax, Kaffir corn, millo maize, Jerusalem corn, African millet, field corn, broom corn, alfalfa, *Bromus inermis*, and potatoes. A list of forest and fruit trees and of small fruits planted and notes on improvements made are also given.

Plan and purpose of illustrative and experimental field work, C. L. GOODRICH (*Hampton Normal and Agl. Inst. Bul. 1, pp. 13, fig. 1*).—Plans for proposed experiments with fertilizers, methods of preparation and cultivation of the soil, and rotation are detailed.

HORTICULTURE.

Experiments with tomatoes, S. B. GREEN (*Minnesota Sta. Bul. 39, pp. 213-217*).—This gives the results of experiments with tomatoes to ascertain the value of pruning and training the plants to stakes as compared with allowing them to run along the ground. Eighteen varieties were employed in the experiment, 3 plants of each variety being set 3 ft. apart and trained to stakes, and 3 others set 5 ft. apart and allowed to spread along the ground. The trained plants were pruned to a single stem and no side shoots allowed to grow. The results were found to vary according to the varieties tested. Chemin Market, Earliest of All, Northern Light, and Terra Cotta ripened fruit

on the staked plants first, while in all the other varieties there was no difference in the date of maturity or else the staked plants ripened their fruit later. The general result of the experiments indicates that greater earliness and productiveness were to be found where the plants were allowed to lie naturally along the ground in the ordinary way. Dwarf Champion and Early Acme gave the largest yields.

A study of the extent to which the tomatoes were affected with rot showed that 43 per cent of the staked tomatoes rotted, while only 19 per cent of the fruit grown on the ground was so affected.

Descriptive comparative notes are given on 16 varieties. The variety Earliest of All proved to be the earliest of those tested.

Vegetable gardening and tests of vegetables, C. L. NEWMAN (*Arkansas Sta. Bul. 34, pp. 99–124*).

Synopsis.—Notes on garden culture in general, thorough tillage and manuring being urged. Fertilizing with acid phosphate increased the per cent of germination and earliness of peas. Variety tests are given for a number of vegetables.

The first part of this bulletin is devoted to the kitchen garden, and discusses its planting and cultivation, urging more careful and extensive culture of garden vegetables. Deep, light, well-drained sandy loams rich in vegetable matter are preferred as garden soils, special attention to be paid to the drainage and amount of vegetable matter present. It is urged that the soil be thoroughly pulverized to a depth of 10 in., plowing and harrowing being continued until the proper friable condition is attained. The application of sufficient fertilizing materials is insisted upon, the ground being manured between each planting of seed. Well decomposed barnyard manure is recommended for general fertilizing, to be equally distributed and thoroughly incorporated with the soil before planting. Thorough and frequent shallow cultivation of the surface, especially after each rain, is stated as necessary not only for loosening the surface soil but also for killing young weeds and grasses. Rotation of crops is recommended to be systematically practiced both for the renovation of the soil and to avoid insect and fungus attacks, and a list is given of vegetables grown on the same land in rotation during one season at the station.

The results of an experiment to test the effect of different fertilizers upon the germination and earliness of garden peas are given; kainit, nitrate of soda, acid phosphate, and cotton-seed meal were applied to 4 plats, respectively, each at the rate of 400 lbs. per acre. Seven varieties of peas were employed in the test, and the soil upon which they were grown was poor, sandy upland. The highest average per cent of germination was 95, found on the plat fertilized with acid phosphate, while the lowest, 66 per cent, resulted on the nitrate of soda plat. The effect upon the earliness was noticed as a secondary matter. The peas planted on the acid phosphate plat germinated from 3 to 4 days earlier, blossomed from 4 to 6 days earlier, and produced ripe pods from 6 to 9 days earlier than those on the other plats. The cotton-seed meal plat was latest at every stage.

Four plantings of cabbage seed were made, the plants being transplanted to the field April 7 and 19, August 18, and December 22. A temperature of 8° F. on December 28 and 29 froze the plants transplanted December 22, but owing to their partially wilted condition only a small percentage was killed, while nearly all of the plants not yet transplanted from the plant bed were killed. Tabulated data are given for 15 varieties, the average weight of heads ranging from ½ to 4⅛ lbs., for the first 3 plantings. The cabbage caterpillars appeared in large numbers, but were checked by spraying with tobacco infusion. The following varieties are recommended: *Early*—Stein Early Flat Dutch, Early Flat Dutch, and Early Jersey Wakefield; *late*—Harvest Home, Large Flat Brunswick, Frotscher Late Flat Dutch, Crescent City Late Flat Dutch, and Improved Early Summer. Brief directions are given for growing cabbages, good seed, rich, deep soil, thorough cultivation, and sufficient water and shade being stated as essential for the production of good cabbages. Rotation of crops is especiallyinsisted upon in the case of cabbages and other plants of the same family, the same soil not to be occupied by them two seasons in succession. It is stated that cabbages will endure a much greater degree of cold than is usually believed, if the cold increases gradually, though a sudden fall of temperature below freezing will kill the plants.

Four attempts to undertake experiments with Irish potatoes failed because of rotting of the seed potatoes and killing of the young plants either by drought or heat.

Comparative descriptive notes are given of 12 varieties of lettuce, 7 of pepper, 3 of eggplant, 6 of cucumber, 4 of squash, 14 of tomato, 5 of radish, 9 of turnip, 6 of onion, 6 of beet, 4 of stock beet, 1 of carrot, 3 of Lima bean, 3 of snap bean, 4 of garden pea, 5 of cauliflower, 2 of sweet corn, and the Burpee Meltrose melon. Tomato plants tied to stakes and pruned ripened larger and better shaped but later fruit than plants allowed to spread along the ground. The staked fruit was also not affected by rot, although badly sun scalded; the staked plants, however, died in October, while the others ripened fruit until after frost. Radishes planted on the north side of soja beans, being thus shaded by them, were crisper and better flavored than others subjected to the sun. The cultural methods employed are briefly given for several of the vegetables.

The colocynth plant, E. S. WALLACE (*U. S. Consular Rpt. 1895, April, pp. 545, 546*).—Notes on the colocynth, which grows abundantly on the plains between the mountains of Palestine and the Mediterranean. The soil is a rich light loam, receiving very little rain, but the cucumber-like plants thrive in spite of the small amount of moisture, producing globular, light-brown fruit, about the size of oranges. The pulp, which is about 25 per cent of the fruit, is the only portion of value, and is gathered in July and August, dried, molded into small balls, and packed and shipped, the annual shipment averaging about

10,000 lbs., worth 30 cts. a pound. It is believed that the soil and climatic conditions of some parts of the United States are adapted to the growth of this medicinal plant.

Horticulture at the Arkansas Valley Substation, F. A. HUNTLEY (*Colorado Sta. Rpt. 1891, pp. 106–109*).—This comprises brief notes on the testing of varieties of beans, cabbage, carrots, eggplant, ground cherry, okra, pumpkins, tomatoes, watermelons, and some other garden crops. Of several varieties of beans planted the middle of July only 3 ripened, Golden Eyed Wax, Black Wax, and Large Yellow Six Weeks alone maturing pods before being killed by frost. Cabbages were 3 weeks earlier when planted in open ground, but seed started in hothouses and later transplanted to the field produced more uniform results. Apples, plums, grapes, raspberries, gooseberries, and currants produced fruit this season.

Improvements to the station buildings are mentioned.

Some special orchard treatment, L. F. KINNEY (*Rhode Island Sta. Bul. 31, pp. 17, figs. 9*).

Synopsis.—A report is given of the successful use of Bordeaux mixture for the prevention of pear scab, and on the treatment of quince and of apples to show (1) effect of fungicides and insecticides on the control of cankerworms, and (2) the commercial advantage derived from their use.

In 1891 a lot of pear trees were sprayed 5 times with Bordeaux mixture, the object being to compare the cost of application with the increased production of salable fruit. The total cost of materials and their application was about 19¾ cts. per tree. On the Clapp Favorite but little advantage was noticed, that variety being able to resist attacks of fungi to a great degree. Eight Sheldons were sprayed at a profit of 53.6 cts. per tree and an Anjou at a profit of 25 cts. These trees each bore between ½ and 1 bu. of fruit. On a Lawrence the treatment was said to have been decidedly beneficial but no figures were given as to the amount of benefit accruing from spraying. The author states the condition of the orchard as follows:

> "In this orchard the parasitic fungi, particularly the Entomosporium and Fusicladium, had become so well established that they regularly prevented the Sheldon, Anjou, and Lawrence trees from maturing their fruit, and by their growth upon the foliage (and fruit) unquestionably damaged the quality of the Clapp Favorite pears.
>
> "This treatment has shown (1) that when the trees were artificially protected from the attack of these fungi they could mature their fruit; (2) that a fair profit resulted from the operation."

Paris green was added to the fungicide at the second and third applications, and while the unsprayed trees were not badly attacked by insects the author thinks it should not be omitted.

Five applications of Bordeaux mixture were given quinces to protect them against the Entomosporium causing leaf blight and cracking of fruit. But little advantage could be seen to have followed the use of the fungicide, due, the author thinks, to improper application, the

bushes being so thickly grown as to prevent their thorough spraying, and also to the first application (May 29) having been given too late.

An application of Paris green 1 oz. to 6 gal. Bordeaux mixture, was given trees May 30 to prevent attacks of the cankerworm, *Anisopteryx vernata.* The cankerworms disappeared so soon that little injury could have followed from their attack. The treatment was successful in preventing the depredations of the codling moth, and other insect pests, showing by the increased quantity and better quality that spraying was a profitable operation.

In testing the commercial advantage accruing from spraying, a lot of 131 trees was sprayed 3 times with Bordeaux mixture to which Paris green was added during the last 2 applications. The total cost of spraying this orchard was $22.13, or 16.9 cts. per tree. Owing to a severe drought the crop was small and was not gathered and graded, hence no accurate estimate of the value of spraying could be made, although the author thought the value of the fruit was increased considerably more than the cost of the treatment. The general conclusions of the author on this experiment are that:

"(1) The fruit from the sprayed trees averaged 14.8 per cent larger than that from the trees that were not treated, or . . . there were 34.1 less apples in a bushel from the sprayed trees than from the others.

"(2) 28.3 per cent more of the apples upon the sprayed trees were sound than upon those that were not [sprayed].

"(3) Among the apples examined there were upon an average 75.1 more wormy specimens per bushel in the fruit gathered from the untreated trees than from the others.

"(4) It was noticed that the apples from the sprayed trees did not decay so soon as those from the untreated trees.

"(5) The codling moth was the principal offender in this orchard, although the increased size of the fruit on the sprayed trees was probably partially due to the protection of the foliage by the use of the Bordeaux mixture from the attack of fungus diseases.

"(6) The treatment should have insured a more complete protection of the apples from the attack of the codling moth than it did. This may have been due to the third application having been made too late, there having been 5 weeks between it and the second."

The spraying apparatus employed is figured and described.

The author calls attention to the necessity of thorough cultivation and fertilization of orchard soils where profitable crops are to be expected.

The treatment of neglected apple orchards, C. M. WEED (*New Hampshire Sta. Rpt. 1893, pp. 169–178, figs. 6*).—This article treats of the proper methods to be employed in caring for apple orchards attacked by insects and fungus diseases. Illustrated descriptive, life-history, and remedial notes are given on the cankerworm, tent caterpiller, and fall webworm, attacking the foliage; and on the codling moth, apple maggot, and plum curculio, injuring the fruit. Attacks by fungus diseases are briefly mentioned and formulas given for preparing copper sulphate solution and Bordeaux mixture. The treat-

ment of neglected orchards is briefly stated to be pruning, followed by spraying. The spraying is to be done as follows: With Bordeaux mixture in the spring just before the leaf buds open, and again just before the blossoms open; with combined Bordeaux mixture and Paris green immediately after the blossoms fall, a second application of the same to be made 10 days or 2 weeks later. The use of brass spraying apparatus is recommended.

Apple crop of Germany, C. DE KAY (*U. S. Consular Rpt. 1895, April, pp. 533, 534*).—This brief report states that German apples are comparatively poor in quality and the yield is far from sufficient to supply the demand. There is a demand for good, sound American fruit, of which not much is shipped to Germany, most of the American apples reaching there being unassorted and often half rotten. It is urged that this market for American apples be taken advantage of and fresh, sound fruit shipped in large quantities.

Dried apples in Cologne, W. D. WAMER (*U. S. Consular Rpt. 1895, April, pp. 535, 536*).—This quotes and remarks upon an official order forbidding the sale of American dried apples, on account of the danger of poisoning by zinc claimed to be in them from their having been on zinc netting. A supplementary note states that this restriction does not apply to apples that have been dried on wooden racks. The consul urges that American firms evaporate their apples, in consequence, only on wooden racks.

Oranges and lemons in Sicily, L. H. BRÜHL (*U. S. Consular Rpt. 1895, April, pp. 527–530*).—This is a report in answer to American inquiries concerning the extent of the crop and the methods used in curing and packing lemons for export. Official figures give 856,168 boxes of oranges and lemons exported from Sicily in 1893, but this number is believed to be much too small.

There is no systematic curing of lemons practiced; the fruit after picking is kept for 15 days in storehouses, when the spoiled ones are culled out and the others wrapped in tissue paper, boxed, and shipped away. The boxes hold from 300 to 400 lemons and average 39 kg. (86½ lbs.) in weight.

The true lemon crop ripens daily from the middle of September to the last of April, being at its prime in November. There is also a forced crop produced in June and July by permitting the trees to lack water in the summer and then watering them extensively in September, when small flowers are produced which bear very small hard fruit the following summer. This method, however, is injurious to the trees. Such lemons as are considered not fit for shipment are cut into halves or quarters, packed in brine, and shipped to confectioners in England.

Olive crop in Spain, C. L. ADAMS (*U. S. Consular Rpt. 1895, April, pp. 530, 531*).—Brief remarks on the crop of 1894, which is 25 per cent below the average yield, on account of spring droughts. The olives in the province of Seville are accounted superior in flavor and quality to

Italian olives and considered the best for the table. Cordova olives, on the other hand, are mostly used for the manufacture of oil, of which $10,000 worth was exported to the United States the past year.

Experiments with small fruits, J. TROOP (*Indiana Sta. Bul. 55, pp. 11–23, fig. 1*).—This consists of notes and tabulated data concerning tests of 80 varieties of strawberries, 9 of red raspberries, 17 of black raspberries, 19 of blackberries, 2 of dewberries, 12 of currants, and 7 of gooseberries. Comparative notes are given on 20 varieties of strawberries, the Brunette being recommended and figured.

Conrath and Kansas were among the earliest raspberries, and the Champion was the most satisfactory gooseberry.

Brief reports are given from farmers in the State at the substations at New Albany and Irvington regarding the various varieties of small fruits and grapes.

The following list of varieties for the home garden is given: *Strawberries*—Brunette, Bubach, Greenville, Haverland, Parker Earle, and Warfield; *raspberries*—Thompson Early, Cuthbert, Tyler, Hilborn, Progress, and Nemaha; *blackberries*—Ancient Briton, Eldorado, Erie, Snyder, and Taylor; *currants*—Red Dutch, Moore Ruby, White Grape, and Wilder; *gooseberries*—Champion, Downing, and Early Orange; *grapes*—Worden, Concord, Salem, Brighton, Diamond, Niagara, and Pocklington.

Horticultural experiments, J. S. ROBINSON (*Maryland Sta. Bul. 33, pp. 117–128*).

Synopsis.—Notes on the culture of strawberries, thorough tillage and manuring with specially compounded commercial fertilizers being urged. Variety tests were made of small fruits and vegetables, and a number recommended as valuable.

This consists of notes on various varieties of fruits and vegetables tested at the station, with special remarks on the importance and profit of growing fruits and vegetables in Maryland for market both in the State and outside.

The cultivation and manuring of strawberries is treated of at length, it being advised that the plants be set out in early spring on newly cleared land in as good condition of tilth as possible. This is to be brought about by working the land one season in a summer crop followed by some green manure crop, such as crimson clover, and later cowpeas, both of which are to be plowed under and the ground well pulverized. At the station this pulverizing was done by means of a home-made "rubber" constructed by bolting six 6 foot pieces of 3 by 4 oak scantling together at the diagonal edges and going over the field with this implement.

An experiment comparing the value of barnyard manure and a mixture of commercial fertilizers costing less than one-fourth as much per acre resulted in a greater growth of vines and earlier and better fruit with the latter manurial agent. It is advised that different fertilizers be applied to new beds and to beds already set, and in the first case

such fertilizers used as will in the beginning quickly give the plants a good start and afterwards supply plant food gradually for a long time; while in the second instance such fertilizers are to be used as will give immediately available plant food. For new beds are recommended a mixture of dissolved South Carolina rock 1,000 lbs., fine ground fish or tankage 600 lbs., nitrate of soda 100 lbs., and muriate of potash 300 lbs., from 400 to 600 lbs. being applied per acre and well worked in before the plants are set out; and for old beds a mixture of dissolved South Carolina rock 1,100 lbs., dried blood 200 lbs., nitrate of soda 400 lbs., and sulphate of potash 300 lbs., applied as a top dressing in the spring at the rate of about 300 lbs. per acre. It is advised that for market purposes 2 or more crops be taken from each bed, the soil between the rows being thoroughly cultivated and fertilized in the summer after the crop is picked.

Ninety-five varieties of strawberries were fruited in 1894 and 140 varieties are expected to bear in 1895. The following varieties are recommended: *Early*—Meek, Michel, and Ella; *late*—Van Deman, Bubach No. 5, Haverland, Barton Eclipse, Lovett, Stayman No. 1, Great Pacific, Crescent, Governor Hoard, Charles Downing, Gandy, and Kentucky. It is advised that in gathering the crop covered trays be given pickers to protect the gathered fruit from the heat of the sun, and that great care be taken to avoid heating and bruising.

Mention is made of 11 varieties of blackberries, 19 of raspberries, 3 of gooseberries, 9 of currants, 15 of grapes, 32 of tomatoes, 18 of cantaloupes, 25 of watermelons, 7 of cabbage, 8 of lettuce, 1 of cauliflower, 20 of peas, and 3 of sweet potatoes tested the past season.

Peaches, apples, and plums were almost a complete failure on account of a disastrous freeze in March, but a number of pears developed fine fruit.

The following varieties are especially recommended: *Blackberries:* Maxwell, Topsy or Tree Blackberry, Lovett, Eldorado, Kent, and Duncan Falls. *Raspberries: Red*—Brandywine, Turner, and Cuthbert; *black*—Souhegan and Kansas. *Gooseberries:* Downing. *Currants:* Fay Prolific, Red Dutch, and White Grape. *Grapes:* Wyoming, Woodruff, Merrimac, Niagara, Hays, Delaware, Concord, Brighton, Worden, Wilder, Salem, Moore Diamond, Eaton, Moore Early, and Agawam. *Tomatoes:* Stone, Buckeye State, Climax, Beauty, Trucker's Favorite, World's Fair, Matchless, and Fordhook First. *Cantaloupes:* Netted Gem, Cole, Anne Arundel, Baltimore Nutmeg, Emerald Gem, Delmonico, and Surprise. *Watermelons:* Kolb Gem, Florida Favorite, Boss, Hungarian Honey, Rocky Ford, Lord Baltimore, and Arkansas Traveler. *Peas:* White Marrow, Alaska, and Triumph.

Report of horticulturist, J. S. ROBINSON (*Maryland Sta. Rpt. 1894, pp. 187–189*).—Brief remarks on the work carried on in this line at the station during the year, treating especially of the distribution of seeds furnished by the United States Department of Agriculture, the failure

of all fruits except pears in the experimental orchard, and the studies of small fruits, strawberries receiving most attention. Variety tests and fertilizing experiments with strawberries are in progress on the eastern shore of Maryland, the results to be published in a future bulletin. One hundred and ten varieties of grapes are in the station vineyard.

Report of the horticultural division (*Massachusetts Hatch Sta. Rpt. 1891, pp. 5–7*).—Brief remarks on the work carried on during the year, tests of different varieties of fruits receiving the most attention. Several varieties of grapes, blackberries, raspberries, and strawberries are noted as having been tested, the Winchell and Peabody grapes, Thompson Pride and Thompson Early Prolific raspberries, and Marshall strawberry being recommended for addition to previously approved lists.

Mention is made of a number of varieties of orchard and small fruits growing on the station grounds, and a list is given of the varieties preferred for market and home use.

Tests of spraying apparatus, fungicides, and insecticides were also carried on.

Sketch of a century of American horticulture, L. H. BAILEY (*Florists' Exchange, 7 (1895), No. 17, pp. 387–391*).—This is a general review of the history of horticulture on this continent, with especial mention of its status during the early part of the present century, and more detailed remarks on the American improved varieties of apples, grapes, and some other fruits, the nursery business, horticultural societies, periodicals and tools, and the transportation of the products.

It is stated that not until after the Revolution was any decided interest shown in horticulture and agriculture, so far as regards writings and systematic scientific improvement of methods and varieties. Apples were among the first fruits to be improved, the Indians playing a part by planting orchards far in the frontiers. At first apples were grown chiefly for cider. European grapes proving unsuccessful in this country, about the first of the century experiments were begun with native wild grapes in Kentucky, Indiana, the District of Columbia, and South Carolina, the varieties Catawba and Isabella having been originated by these early efforts. Brief notes are given on the development of the cranberry, strawberry, blackberry, dewberry, and the American gooseberry and plum, and the history of such introduced fruits as the peach, orange, and pear, which in many instances thrive in this country better than in their native habitat.

It is stated that the first distinct nursery in America was established on Long Island about the middle of the last century, while seed firms began to exist about the first of this.

The progress of horticultural periodicals and books is given in some detail, *The New England Farmer*, founded in 1822, being mentioned as one of the first periodicals giving much space to horticulture. The growth of landscape gardening in this country is outlined as applied

chiefly to parks and cemeteries. The work of the experiment stations is mentioned, and a belief is expressed in a continued improvement along horticultural lines with increasing knowledge of various limitations and means of overcoming them.

The horticulturist's rule book, L. H. BAILEY (*New York: Macmillan & Co., 3d ed., pp. 302*).—This, the third revised and enlarged edition of this well-known book, gives, in descriptive and tabulated shape, much information of value to horticulturists and agriculturists. Among the topics treated of are the more important injurious insects and plant diseases, concise but comprehensive notes being given on them and many insecticides and fungicides, with numerous formulas and directions for employing remedies. Injuries by small animals and birds are also mentioned. Formulas for the preparation of several grafting waxes, cements, paints, etc., and tables giving information on the seeding, planting, and maturity of different crops are given, as also a number of computation tables on subjects of interest to agriculturists. Improved methods are cited for keeping and storing fruits and vegetables for market and preserving specimens for exhibition. Chapters are included on greenhouse work and heating, and the current literature of American horticulture. Rules adopted by various pomological, horticultural, and florists' societies for the grading of horticultural products are quoted, some remarks are made on weather indications, and the foreign names, histories, statistics, and analyses of a number of fruits and vegetables are presented. A glossary of horticultural terms is appended, and the work throughout is valuable for reference to both professional and amateur horticulturists.

Lists of vegetables and fruits recommended for cultivation in North Carolina (*North Carolina State Hort. Soc. Rpt. 1894, pp. 30-37*).—Annotated tables of preferred varieties of garden vegetables and orchard and small fruits.

Two wild vegetables of merit, F. W. CARD (*Garden and Forest, 8 (1895), No. 380, pp. 223, 224*).—A discussion of the advantages of wild lettuce (*Lactuca canadensis* and *L. ludoviciana*) and ground plum or buffalo pea (*Astragalus crassicarpus*) as early vegetables, and advising their cultivation.

The cultivation and manufacture of arrowroots, J. R. BOVELL (*Bot. Sta. Barbados Misc. Bul. 5, pp. 1-11*).—Popular information on the subject, chiefly compiled from Kew bulletins.

Is parsnip poisonous? L. H. PAMMEL (*Garden and Forest, 8 (1895), No. 380, p. 228*).—The writer believes that the various reported cases of poisoning from *Pastinaca sativa* are not authentic, and considers it harmless.

Peach growing in Georgia, L. J. VANCE (*Garden and Forest, 8 (1895), No. 382, p. 248*).—Some statistics as regards its extent and the varieties preferred, Elberta leading.

Shall we irrigate orchards in New York? L. H. BAILEY (*Garden and Forest, 8 (1895), No. 381, pp. 236, 237*).—Tillage is advised in preference to irrigation.

Why and how to grow fruits, H. E. VAN DEMAN (*North Carolina State Hort. Soc. Rpt. 1894, pp. 13-15*).—General remarks on the selection of soil and varieties, and cultivation, spraying, etc.

Raspberries, S. B. GREEN (*Minnesota Sta. Bul. 39, pp. 226-229, fig. 1*).—Comparative notes and tabulated data on 20 varieties of tip rooting and 13 varieties of sucker raspberries. Cook Seedling, Nemaha, Older, Palmer, Golden Queen, Marlboro, and Thompson Early seem to have given the best results. The culture employed is briefly mentioned.

Strawberries, S. B. GREEN (*Minnesota Sta. Bul. 39, pp. 223-225*).—Comparative descriptive notes on 30 varieties of strawberries fruited at the station in 1894. Warfield is recommended as the best early and Parker Earle the best late variety. The following varieties are also recommended: Haverland, Crescent, Beder Wood, and Enhance. New varieties, Swindle, Edgar Queen, and Leader.

Garden herbariums, F. W. CARD (*Garden and Forest, 8 (1895), No. 382, pp. 242, 243*).—Some general remarks advising the preservation of horticultural specimens for study. The subject was briefly discussed in E. S. R., 6, p. 489.

Roses, J. H. HART (*Roy. Bot. Gard. Trinidad, Misc. Bul. 2 (1895), No. 2, pp. 45-47*).—Brief notes on roses in the West Indies, well sheltered but unshaded localities and deep rich soil being stated as necessary for their best development, and the plants to be rested during the dry season by picking off all forming buds.

The origin of the cultivated cineraria, W. T. THISELTON DYER and W. F. R. WELDON (*Nature, 52 (1895), No. 1336, pp. 128, 129*).

Report of horticulturist, C. S. CRANDALL (*Colorado Sta. Rpt. 1894, pp. 47-51*).—Brief notes on the work in the section of botany and horticulture during the past season, tests of orchard fruits and garden vegetables being the main features. In addition the flora, especially the weeds of the State, is being studied, two field trips having been made for the purpose.

FORESTRY.

The mesquite tree, its products and uses, R. H. FORBES (*Arizona Sta. Bul. 13, pp. 15-26*).

Synopsis.—The author gives an account of the character and distribution of the tree, the quality of its wood, analyses of its various parts and products, and uses to which they may be applied.

The mesquite tree, *Prosopis juliflora*, is indigenous to the Western Hemisphere, and it is said to thrive best in the dry, elevated regions of the southwestern part of the United States. Its range is roughly given as from central Texas west to California, and from northern Arizona and New Mexico southward. It varies in size from a small shrub to trees 3 ft. in diameter and 50 ft. in height. It is ordinarily a slow growing tree, but atmospheric and other conditions influence it in this regard. When once established the tree will withstand extremes of heat and dryness. In density the wood ranks with white oak, ash, or elm, while it is grouped with some forms of white pine in its strength and elasticity. Its fuel value is about equal to hickory or white oak and in some regions it is about the only fuel, even the large roots being dug up for this purpose. It makes excellent charcoal both when burned as pit coal or as open air coal. Three samples gave as their ash content 3.44, 3.57, and 5.16 per cent, one sample of the ash containing potash 3.49, soda 0.15, lime 28.98, and phosphoric acid 0.68 per cent.

Exuding from the bark are found small masses of white or amber-colored gum which resembles gum arabic in appearance and properties, but it differs in not being precipitated by basic lead acetate. This gum has various uses, being reputed as of medicinal value. A second gum, so called, exudes from cuts in the wood. It occurs in large black masses, and the author considers it probably the dried sap of the tree. It was found upon analysis to contain water 7.04, soluble matter 27.02, tanning materials 20.64 per cent, gum a trace.

Tannin seems present in considerable quantity in all parts of the tree; analyses showed the bark to contain 3.54, the wood 5.57, the black gum 22.02, and the leaves 6,02 per cent.

Probably the most important product of the tree is its fruit, or beans as they are commonly called. They are readily eaten by stock, and contain a large amount of nutrient material. Various analyses are given of the whole bean, the seeds and pods separately, and of the leaves, the average of the analyses being given in the following table:

Average composition of mesquite beans and leaves.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Entire bean	6.58	4.87	13.91	24.40	53.94	2.88
Pods	5.64	5.33	6.21	32.49	54.48	1.49
Seed	7.81	3.49	37.33	6.60	46.51	6.09
Hull from seed	8.92	2.13	9.91	9.39	77.45	1.12
Kernel of seed	6.36	4.14	53.48	4.53	28.66	8.90
Leaves[1]	....	8.60	17.50	28.90	40.10	4.90

[1]Analysis of 1 sample.

The above analyses show that mesquite compares favorably with such common feeding stuffs as alfalfa hay, corn fodder, shelled corn, and wheat bran.

It is stated by the author that the beans themselves are very hard and that they often pass through animals undigested; hence he recommends that before being fed the pods and beans should be finely ground.

Several minor uses to which this tree and its products are adapted are given, one of which is its value as a honey plant, on account of its long flowering period, extending over about 2 months. It is also thought possible to use the tree for hedges as well as in some forestry relations where it may prove valuable. It is of slow growth and on this account will not do very well for forest planting, and the preservation of the present forested areas is strongly urged.

Forest tree plantation, J. A. BALMER (*Washington Sta. Bul. 12, pp. 20*).—This bulletin discusses the study by the station of various forest trees native to the State and also those imported into it, with notes on the various species showing their adaptability to this portion of the State. Large plantings of very young deciduous and evergreen trees and shrubs were made in the spring of 1892. The trees have grown with varying success, in some cases being retarded by frost before setting out and by the fact that a portion of the nursery was not well drained. Many of the evergreens suffered from a too moist soil, but others made a good growth. A list is given of over 80 species of deciduous trees and shrubs and 22 species of evergreens growing in the plantation, with notes indicating the increase in height since their planting, the number surviving the first year, and the hardiness. Of the maples several species were found to be not hardy at the altitude of the station, 2,400 ft., especially the large leaved or Oregon maple (*Acer macrophyllum*). The silver maple (*A. dasycarpum*) is considered one of the best for planting, being a hardy, beautiful tree of rapid

growth. The sugar maple (*A. saccharinum*) and English maple (*A. campestre*) are also recommended. Red and white flowered horse chestnuts (*Æsculus* spp.) were planted and both are considered valuable for yard and street planting. The white birch (*Betula alba*), the ashes (*Fraxinus* spp.), the poplars (*Populus* spp.), the mountain ashes (*Pyrus americana* and *P. aucuparia*), and the elms (*Ulmus* spp.) have all done well and are highly recommended for planting purposes.

Of the evergreens, the larches (*Larix* spp.), spruces (*Picea* spp.), and pines (*Pinus* spp.), with the exception of the Corsican pine (*P. laricio*), have proved themselves well adapted to the climate and soil. The hornbeam (*Carpinus caroliniana*), the poplars, and the Norway spruce (*Picea excelsa*) are recommended for wind-breaks. As hedge plants are suggested the honey locust, osage orange, hawthorn, Scotch broom, arbor vitæ, hemlock, spruce, and a few other evergreens. Some walnut and hickory trees tested on a farm near the station and given little care made an excellent showing, growing well and producing a number of nuts. It is strongly recommended that groves of nut-bearing trees be planted in the State, walnuts, hickory nuts, hazel nuts, and filberts being suggested.

Many of the trees and shrubs showed a tendency toward bushiness, branching very near the ground and growing strongly. This was especially noticeable in the lindens, maples, and elms.

Brief directions are given for setting out and caring for young trees, especially for evergreens, and directions are also given for the planting of wind-breaks, in which it is advised that evergreens be set in 3 alternating rows 15 ft. apart and the same distance between the trees.

Results of experiments in tree planting on the Northwest plains, W. SAUNDERS (*Trans. Roy. Soc. Canada 1891, pp. 113, 114*).—Experiments were begun in 1888 in testing trees and shrubs suitable for planting on the Northwest plains. In 1889, 12,000 trees and shrubs were sent from the central experimental farm at Ottawa to each of the branch farms in the West. These consisted of 118 varieties, of which about 60 per cent died before the following spring. In 1890 another consignment of about 21,000 each was sent, a considerable number of which proved tender. A very large number of native trees has been grown at the branch and central farms from seed, especially the box elder, white elm, green ash, and bur oak. These are succeeding admirably. Several varieties of Russian poplars and willows have done well, particularly *Populus bereolensis*, *P. certinensis*, and the Voronesh willow. As the result of the 6 years' experiment there are now growing at the branch farm at Indian Head 120,000 trees and shrubs, and at Brandon, 75,000.

A statement is given by the author of the distribution of trees and tree seed by the central farm in the past 4 years.

Close planting of hardy young trees for shelter hedges has been found advantageous, forming an excellent protection for the growing of small fruits, vegetables, and other tender crops. These hedges have

been chiefly made by the Russian poplars, box elder, elm, ash, and willow, planted in double rows at distances of 1 by 2 ft. to 4 by 4 ft. The Russian poplars have thus far made the most rapid growth. A variety of Artemisia (*A. abrotanum tobolskianum*) is said to be valuable for hedges on account of its ready growth from cuttings. The Siberian pea tree (*Caragana arborescens*), which grows readily from seed, is also recommended for hedges. The tests which have been made on the western experimental farms show that there are about 100 varieties of trees and shrubs sufficiently hardy to endure the climate of that region, and further tests are adding to this number from year to year.

Swiss market for American woods, E. GERMAIN (*U. S. Consular Rpt. 1895, April, pp. 509–515*).—This article states the demand in Switzerland for timber and lumber, which has to be supplied mostly from outside. In 1893, $36,608 worth of lumber was imported from the United States, and it is stated that a much greater amount of American material could find market in Switzerland, being employed for shipbuilding, carriage making, staves, house finishings, cabinets, etc. Letters are quoted from various Swiss manufacturers showing that American oak, beech, hickory, elm, walnut, and pine lumber are extensively in demand.

The beech, J. T. ROTHROCK (*Forest Leaves, 5 (1895), No. 3, pp. 40, 41, pls. 2*).—A popular paper on *Fagus ferruginea*, with illustrations from photographs showing the open ground and forest forms of the tree.

Hybrid birches, J. G. JACK (*Garden and Forest, 8 (1895), No. 382, pp. 243, 244, fig. 1*).

Street trees (*Garden and Forest, 8 (1895), No. 380, pp 221, 222*).—Recommends greater care in the selection of trees, and better methods of planting. Norway maples, elms, tulip trees, and pin oaks are suggested among others.

Are forest fires a necessary evil? B. E. FERNOW (*Garden and Forest, 8 (1895), No. 382, p. 242*).—The writer believes that most forest fires are due to neglect, often on the part of railroads, and can be obviated by proper precautions.

The practical influence of forestry on the surface of our country, M. F. WEBER (*Forest Leaves, 5 (1895), No. 6, pp. 41–44*).—A popular paper.

SEEDS—WEEDS.

Weeds, and how to kill them, L. H. DEWEY (*U. S. Dept. Agr., Farmers' Bul. 28, pp. 31, figs. 11*).—Popular information is given on weed propagation and methods for eradication. Illustrated descriptive notes together with suggestions for their destruction are given of the following 10 weeds, concerning which there were numerous inquiries during the past year: Prickly lettuce (*Lactuca scariola*), bracted plantain (*Plantago aristata*), horse nettle (*Solanum carolinense*), buffalo bur (*S. rostratum*), spiny amaranth (*Amarantus spinosus*), dagger cocklebur (*Xanthium spinosum*), chondrilla (*Chondrilla juncea*), wild carrot (*Daucus carota*), wild oat (*Avena fatua*), and false flax (*Camelina sativa*).

The list is given in order of importance, the Russian thistle, on which there has been issued a separate bulletin,[1] exceeding the others.

[1] Farmers' Bul. 10; U. S. Dept. Agr., Div. Bot. Bul. 15 (E. S. R., 6, p. 144).

A table is given of 100 weeds arranged in alphabetical order. The common and technical names, region infested, duration, time of flowering, time of seeding, color, size and arrangement of flowers, methods of propagation and distribution of seed, place of growth, products injured, and methods of eradication are all briefly stated.

Viability, purity, and germination of seed, G. McCARTHY (*North Carolina State Hort. Soc. Rpt. 1894, pp. 24-27*).—Some general remarks are given on the subject of seed testing, with tables showing the average per cent of viability and purity and the maximum, minimum, and proper germination temperature for a number of forage plant, vegetable, and flower seeds.

The mixing of grass seed, F. G. STEBLER (*Die Grassamen-Mischungen zur Erziehung des grossten Futterertrages von bester Qualitat. Bern: F. I. Wyss, 1895*).

The Russian thistle in California, C. H. SHINN (*California Sta. Bul. 107, pp. 16, pl. 1*).—A popular report is given of this weed, its characteristics, spread throughout the United States, and introduction into California. Suggestions are given for the suppression of this pest.

Cockspur (Centaurea melitensis), J. H. MAIDEN (*Agl. Gaz. N. S. W., 6 (1895), No. 3, pp. 149-151, pl. 1*).—Description and notes on the eradication of this Australian weed.

The destruction of Rhinanthus, A. CARRE (*Prog. Agr. et Vit., 12 (1895), No. 23, pp. 609, 610*).

The extent of the injury to crops caused by weeds (*Abs. in Fuhling's landw. Ztg., 44 (1895), No. 11, p. 355*).—Data are given concerning the yield of peas, beans, potatoes, and roots on plats kept clean or allowed to become weedy.

The weeds of New South Wales, I, J. H. MAIDEN (*Agl. Gaz. N. S. W., 6 (1895), No. 3, pp. 152-159*).—A popular article.

DISEASES OF PLANTS.

Potato diseases, S. B. GREEN (*Minnesota Sta. Bul. 39, pp. 208-213, fig. 1*).—The author gives popular notes on potato scab, potato blight, and an internal brown rot of potatoes. Corrosive sublimate is recommended as a preventive treatment for the scab and Bordeaux mixture for the blight. Formulas and directions for their application are given. The use of insecticides upon potatoes is urged, and in addition to the usual ones, Paris green and London purple, arsenate of lead is highly esteemed.

During the past season an apparently new disease made its appearance throughout a considerable portion of the State, to which the name of internal brown rot has been given. The disease affects the inside of the tuber, the outside appearing perfectly normal; the diseased condition is shown as an aggregation of brown spots when the tuber is cut open. These spots may accumulate near the center or near the outside, but usually they are scattered throughout the tuber. Their presence seems to have no effect on the starch content of the potato. The disease seems to affect nearly all varieties of potatoes, only 3 out of 31 tested at the station escaping, the others having from 5 to 100 per cent of the crop more or less discolored.

Apple tree sun scald, S. B. GREEN (*Minnesota Sta. Bul. 39, pp. 217-222, figs. 4*).—According to the author, by the term "sun scald" is

meant the trouble that shows itself by the tree becoming rotten in the trunk on the south side, which finally so weakens it that it can not support its top, and consequently breaks down, very likely when loaded with fruit. It is probable that this trouble is generally caused by a part of the bark on the south—or, more commonly, the southwest—side of the tree starting into growth before the rest of the tree, during some warm period in the latter part of winter or early in the spring. Such warm periods are generally followed by a severe freeze, in which case the newly formed immature cells are ruptured, or the cell contents injured, which results in the bark on the affected side dying and falling off.

The author says that sun scald is probably the cause of the most frequent loss of apple trees, and it may be entirely prevented by anything that will shade the tree trunks. Several methods are suggested, all of which are said to be efficient not only in protecting trees against the scald but also from attacks of rabbits, mice, etc. The author recommends that all fruit trees be planted so as to lean toward the southwest, the direction from whence are the prevailing winds of that region.

Sun scald seems to affect apple trees to a greater extent than any other, although almost all deciduous trees are liable to injury to some extent.

Cane rust of raspberries, S. B. GREEN (*Minnesota Sta. Bul. 39, pp. 230, 231, fig. 1*).—Cane rust or anthracnose of raspberries is figured and briefly described, and from its successful use at the station in combating the disease the following treatment is recommended:

In the spring, before the canes start, spray them with a solution of sulphate of copper (blue vitriol) made by dissolving 1 lb. of it in 15 gal. of water. Later, spray the new canes with Bordeaux mixture, probably about 3 times at intervals of about 2 weeks, commencing as soon as the new canes are 1 ft. high. Care should be taken not to get the Bordeaux mixture on the leaves of the fruit-bearing canes, as they are quite liable to be burned by it.

Spraying of orchards, E. G. LODEMAN (*New York Cornell Sta. Bul. 86, pp. 47–76, figs. 8*).

Synopsis.—The author reports upon experiments in spraying to prevent fungus diseases of the apple, quince, and plum.

Notes on spraying apple orchards (pp. 47–68).—The principal enemies of the apple orchard are the apple scab and codling moth, and the author has considered the methods for application of Bordeaux mixture, time to spray, quantity of fungicide to be used, and the best method for preparing it. He considers hand pumps the most satisfactory for spraying orchards, as power machines do not throw enough liquid nor do they throw it far enough for use on large trees, although they are excellent for spraying grapes and other low-growing plants. Bordeaux mixture, copper sulphate solution, and London purple were the fungi-

cides used. Two, 4, and 5 applications of the fungicide were given the trees, beginning before the flower buds opened and ending about 4 weeks after all petals had fallen. For the King variety it was found that 4 applications gave better results than 2 or 5, and the author thinks that 3 applications would have been sufficient. The most important applications are the ones given just before blossoming and immediately after the fall of the petals. If a third spraying is necessary it should follow the second by about 2 weeks. The investigations of the author showed that 3 gal. of Bordeaux mixture was about the proper amount for trees 25 to 30 years old, and in addition to its fungicidal value it acts as an insecticide, being especially valuable for curculio injuries.

From the author's observations applications of Bordeaux mixture seem to have little if any effect on the subsequent year's crop, but on this point further experiments are necessary.

Solutions of copper sulphate for the early spraying may be valuable if orchards are thoroughly and uniformly sprayed, but the author states that where check trees were left as sources of infection its value was not very marked. London purple is said to have no fungicidal value. No attempt was made to control insect injuries, as it was thought unnecessary, owing to the isolation of the orchard and the fact that arsenites had been thoroughly used for the preceding two seasons. It was shown that previous seasons' applications of arsenites had no effect in controlling or preventing insect attacks. Where insecticides are used Paris green is recommended as the most reliable.

The author discusses the subject of injury to fruit from the use of Bordeaux mixture containing an excess of copper, which is liable to be the case when carelessly made by color test. An excess of lime is recommended as likely to prevent this injury where it is due to the corrosive action of the Bordeaux mixture. The character of the season seems to have something to do with the production of rusty fruit. Quotations are given of the results obtained by various persons in spraying their orchards. It is shown that want of proper cultivation and fertilization is the cause of the failure to produce fruit in some orchards.

Notes on spraying quinces (pp. 68–70).—The trees were sprayed to prevent attacks of *Entomosporium maculatum*, and it is shown that the proper application of Bordeaux mixture will control this disease. The applications need not be given the trees as early as is advised for apple trees, for the attack rarely becomes severe before July.

Notes on spraying plums (pp. 70–74).—Notes are given on investigations for repression of the leaf spot (*Septoria cerasina*) and fruit rot (*Monilia fructigena*) of stone fruits. The former may be controlled by giving the trees 2 or 3 applications of Bordeaux mixture at intervals of from 2 to 4 weeks, beginning about 2 weeks after the fall of the blossoms. The second may be controlled according to the following method of treatment:

"(1) Spray the trees with the copper sulphate solution before the buds break; (2) when the blossoms have fallen apply the Bordeaux mixture; (3) when the fruit

is about two-thirds grown repeat the second; (4) if necessary spray with the ammoniacal solution of copper carbonate."

It was found that the use of Bordeaux mixture on plums resulted in thicker leaves; the particular cells which were enlarged by the treatment were not definitely determined, but they appeared to be the palisade cells that were elongated. Further observations are needed to establish this fact.

Spraying pear and apple orchards in 1894 (*New York State Sta. Bul. 84, pp. 36, figs. 7*).—The experiments of 1894 were in continuation of those reported in Bulletin 67 and the Annual Report of the station for 1893.[1] Their object was (1) to ascertain the least number of applications of a Bordeaux mixture containing 1 lb. of copper sulphate to 11 gal. of water that will prevent injury by the scab fungus, and the proper time for their application; (2) to what extent is late spraying liable to cause injury to fruit, and (3) to what extent will the benefits of one season's spraying influence the crop of the next year?

The principal experiments were conducted on pear trees, Seckel being the variety mostly used, and the results obtained for this variety are given in detail. Five applications of the fungicide were made, beginning with 2 before the buds opened and 3 after the fall of the petals. It was found that 3 sprayings gave the best results, the first treatment just before blossoming, the second immediately after the fall of the petals, and the third from 10 to 14 days later. To prevent attacks of the codling moth arsenites may be added to the second and third spraying. If the eye spotted bud moth (*Tmetocera ocellana*) is feared use arsenites with the first application also. The trees receiving the treatment recommended above bore on an average 1.06 bu. more fruit per tree and more than 5 times as much first-class fruit per tree as did the unsprayed trees. The author thinks for some of the varieties more susceptible to the disease an additional application of the fungicide after blossoming will ordinarily prove advantageous.

For apple orchards the same treatment recommended for pear trees is advised.

The author recommends a simple expression for stating the strength of Bordeaux mixture, and advises stating it in the form of a proportion, the first unit being the amount in pounds of copper sulphate and the second the number of gallons of water. He calls the strength used in his experiment a 1 to 11 solution.

The author investigated the question, "To what extent is the Bordeaux mixture treatment liable to cause a roughness or russeting of the fruit?" He quotes numerous authors who seem to believe that Bordeaux mixture when improperly made will injure fruit. This seems to be liable to follow when the mixture is made by the potassium ferrocyanid test. This color test as well as the still more delicate ones, iodin and starch paste, and potassium xanthate are described, and the author

[1] E. S. R., 5, p. 986.

recommends the addition of a little lime to the mixture after there is no change of color shown by the test. In this way the corrosive action of the mixture will be avoided. The author states that while Bordeaux mixture made by the potassium ferrocyanid test may have done injury to foliage and fruit, injury was also done where the color test was not used. Whether the injury done where the color test was used was greater than the other is yet to be determined.

The results obtained in the experiments to ascertain the influence of spraying on the next season's crop showed a slightly increased yield where the trees had been sprayed the previous year. When it is considered that the sprayed trees bore 3 times as much fruit in 1893 as did the unsprayed ones the author thinks strong evidence in favor of spraying is shown in the fact that in 1894 these trees were able to overcome the injurious effect of overbearing and still equal or slightly exceed the yield of the trees not sprayed the previous year. He states that "the permanent injurious effects of the scab fungus on the unsprayed trees in 1893 was no greater, if as great, as the permanent injurious effects of excessive yield of the sprayed trees, even though their foliage was kept in good condition by the spray. . . . Even when trees are sprayed, large annual crops of fruit ought not be expected unless they are well fed and not permitted to overbear."

Fungicides, insecticides, and spraying calendar, S. T. MAYNARD (*Massachusetts Hatch Sta. Bul. 29, pp. 11, fig. 1*).—Directions are given for the preparation and use of Bordeaux mixture, ammoniacal copper carbonate, Paris green, and kerosene emulsion. Forms of spraying apparatus are described, special mention being made of an automatic agitator for a barrel spray pump. A spraying calendar is given for the prevention of fungus and insect attacks on the apple, pear, peach, cherry, grape, raspberry, blackberry, currant, strawberry, potatoes, celery, and black poplar trees.

Smut in wheat, W. M. HAYS (*Minnesota Sta. Bul. 40, pp. 289–292*).—The author gives popular notes on wheat smut, and describes methods for the preventive treatment of the seed before sowing. The methods described are those employing copper sulphate and the hot-water treatment.

Prevention of potato blight, H. H. LAMSON (*New Hampshire Sta. Bul. 22, pp. 8, figs. 2*).—Potato blights caused by *Macrosporium solanum* and *Phytophtora infestans* are fully described, and applications of Bordeaux mixture recommended for their prevention.

A cheap and efficient method of combating Oidium, Peronospora, and insects affecting the grape, S. MARTINI (*Riv. Ital. Sci. Nat., 15 (1895), No. 5, pp. 59–61*).

A preliminary contribution to the knowledge of Septoria graminium, F. KRÜGER (*Ber. deut. bot. Ges., 13 (1895), No. 4, pp. 137–141, table 1*).

A contribution to the knowledge of karyokinesis in plants, W. BELAJEFF (*Flora, 1894, pp. 430–442; abs. in Bot. Centbl., 62 (1895), No. 10, pp. 328, 329*).

A remedy for pear blight, M. B. WAITE (*Science, n. ser., 1 (1895), No. 26, p. 721*).—A preliminary report on treatment for pear blight.

The smut of sorghum, E. PRILLIEUX (*Bul. Soc. Bot. France, 44 (1895), No. 1, pp. 36–39, fig. 1*).—The author figures and describes *Ustilago sorghi*, which is reported as becoming destructive to sorghum in southern France.

Concerning the spraying of grapes, A. BAUER (*Würt. Wochenbl. Landw. 1895, No. 22, pp. 310–313*).

Diseases of wheat, grape, and sainfoin, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 23, pp. 600, 601*).—Brief notes on the occurrence of injuries and means for their prevention.

Report of the bacteriologist, H. H. LAMSON (*New Hampshire Sta. Rpt. 1893, pp. 160–168, figs. 4*).—The author gives a report on treatment for pear scab and potato diseases and formulas for fungicides. The most of the material of the article on pear scab and cracking of pears may be found in Bulletin 19 of the station (E. S. R., 6, p. 302), as are the formulas for the fungicides. A report is given of preliminary experiments for the repression of *Macrosporium solani*, but the results are so indefinite that no conclusions can be drawn from them.

Plant diseases, G. E. STONE (*Massachusetts Agl. College Rpt. 1894, pp. 139–152*).—The author gives a general statement of the nature of plant diseases, their causes, and the relationship between parasitic fungi and their hosts. Compiled notes are given describing the following diseases and recommendations are added for their prevention: Carnation rust (*Uromyces caryophillinus*), carnation leaf spot (*Septoria dianthi*), anthracnose of carnations, powdery mildew (*Sphærotheca pannosa*), rose rust (*Phragmidium subcorticium*), gooseberry rust (*Æcidium grossulariæ*), powdery mildew (*Sphærotheca mors-uvæ*), clubroot of cabbage (*Plasmodiophora brassicæ*), potato scab (*Oöspora scabies*), fruit mold of the peach, plum, and cherry (*Monilia fructigena*), damping fungus (*Botrytis vulgaris*), bacterial diseases, and nematode worms.

Treatment of common diseases and insects injurious to fruits and vegetables (*New York State Sta. Bul. 86, pp. 69–120, figs. 4*).—Popular and to a great degree compiled notes are given on the treatment of the more common diseases and insects injurious to fruits, vegetables, and nursery stock, and formulas for the manufacture of fungicides and insecticides and directions for their most successful application. When a certain treatment is recommended by the author it is one that has been tested and found effective, while in other cases remedies are simply suggested whose efficiency has not yet been demonstrated.

ENTOMOLOGY.

Some injurious insects, C. P. LOUNSBURY (*Massachusetts Hatch Sta. Bul. 28, pp. 30, figs. 11, pl. 1*).—This consists of more or less elaborate notes on insects of importance to farmers, illustrated descriptive, life-history, and remedial notes being given on the spring cankerworm (*Paleacrita vernata*), fall cankerworm (*Anisopteryx pometaria*), army worm (*Leucania unipuncta*), corn worm (*Heliothis armigera*), red humped apple tree caterpillar (*Œdemasia concinna*), antiopa butterfly (*Euvanessa antiopa*), currant stem girdler (*Phylloecus flaviventris*), imported elm bark louse (*Gossyparia ulmi*), and greenhouse orthezia (*Orthezia insignis*).

Against the cankerworms is recommended surrounding the trees with paper bands covered with some sticky substance to prevent the ascent of the wingless female moths. Bands of cotton batting are also recommended as barriers, and spraying with Paris green, London purple, or arsenate of lead is advised if the caterpillars have gained a foothold and are proving destructive to the foliage.

The army worm was quite abundant and destructive in Cape Cod cranberry bogs, where they are believed to have hibernated in the egg

stage. Plowing deep furrows around infested fields, spraying with Paris green, placing obstructions smeared with coal tar or kerosene in the line of march, or digging ditches across their path and filling them with water are recommended, as is also burning the fields over during the winter.

The corn worm attacked both corn and tomatoes, being especially injurious in the vicinity of Boston. Fall plowing of infested fields to destroy hibernating pupæ is advised.

The red-humped apple tree caterpillar was quite abundant during the season, affecting not only apple trees, but other orchard trees, blackberry and rose bushes, etc. Burning the colonies on infested branches is recommended.

The caterpillar of the antiopa butterfly was frequently sent to the station by persons who had mistaken it for the larva of the gypsy moth. It was chiefly destructive to the elms. Trimming off and destroying infested branches or spraying with arsenicals is recommended.

The currant stem girdler was injurious to the young growth of currant from the girdling of the tips by the adult and the burrowing in the pith by the larvæ. The female cuts several curved gashes near the tip of the twig in May, the caterpillar burrowing down the stem until fall, and, hibernating in the larva state, pupating and issuing as adult in the spring. The larva is described for the first time, being of a glistening straw yellow and two fifths of an inch in length. It is cylindrical, with a fleshy expansion along the sides, and a minute dark spine on the dorsal surface of the thirteenth (last) segment. The seventh to twelfth segments bear on each side a small round reddish spot. Pruning and burning girdled canes as soon as noticed is recommended.

The imported elm bark louse has been in Massachusetts about 8 years, affecting different species of elms in various parts of the State. Young trees suffer more than older large ones, which are apparently better able to withstand the attacks. Experiments in spraying with kerosene emulsion were successful, and this remedy is therefore recommended. To be effective, however, exceedingly strong emulsions must be used, the stock solution being diluted only 2 or 3 times with water.

The greenhouse orthezia was in a number of greenhouses in the State, but chiefly about Boston. A list of 26 food plants is given, of which coleus suffers most from its attacks. Preventive measures are stated to be more important than remedial ones, as the tender nature of most of the plants infested makes the use of insecticides a dangerous matter. Using cuttings from uninfested plants only is advised, infested cuttings or plants to be at once destroyed. Fir-tree oil and kerosene emulsion are recommended as the most efficient and safest insecticides.

Report of entomologist, C. P. GILLETTE (*Colorado Sta. Rpt. 1894, pp. 58–64*).—This consists of brief notes on the insect pests of the year

and a report on a trip by the entomologist to the western portion of the State to investigate insect injuries. The leaf rollers (*Cacœcia argyrospila* and *C. semiferana*), the apple woolly aphis, and the cabbage louse were the most prominent injurious insects during the year. Directions are given for spraying with Paris green, kerosene emulsion, and hot water for the 3 insects, respectively. For the leaf rollers winter applications of kerosene emulsion are also advised.

In the western part of the State 3 leaf hoppers (*Gnathodus abdominalis*, *Agallia uhleri*, and *Platymetopius acutus*) and the mealy bug (*Dactylopius solani*) were injuriously abundant on beets, while the codling moth was found frequently present in apple orchards. The clover mite (*Bryobia pratensis*) was damaging many orchards, attacking pear, apple, plum, and cherry trees in the above order, collecting on the underside of the limbs and twigs and causing the foliage to become blanched and sickly. Spraying with kerosene emulsion or resin wash is suggested as treatment. The woolly aphis, a leaf hopper (*Typhlocyba comes*), and a new scale (*Aspidiotus howardii*) were also found infesting orchards, but not seriously.

Brief mention is made of the experiments carried on with the apiary, different dry foods being offered as substitutes for pollen. Of these finely ground oats and corn were taken most frequently and bean and barley meal less preferred. Bees wintered on honey made from granulated sugar did not do well. A list of the Hemiptera of the State is in course of preparation.

Some dangerous fruit insects, C. M. WEED (*New Hampshire Sta. Bul. 23, pp. 22, figs. 18*).—This consists of some general remarks on noxious insects and their ravages and injuries, with illustrated descriptive, life-history, and remedial notes on the pear midge (*Diplosis pyrivora*), pear tree psylla (*Psylla pyri*), bud worm (*Tmetocera ocellana*), San José scale (*Aspidiotus perniciosus*), and gypsy moth (*Ocneria dispar*).

The crowding of crops, easy transportation, abandoned farms, and destruction of forests and cultivation of prairies are given as some of the causes for the increase of noxious insects; and the annual loss of crops in the United States due to insect damages is given at nearly half a billion dollars.

The following remedies are recommended against the several insects: Pear midge, applying kainit to the ground about the middle of June, 1,000 lbs. to the acre; pear tree psylla, spring spraying with dilute kerosene emulsion; bud worm, spring spraying with the arsenites or a combination of Bordeaux mixture and Paris green; San José scale, spraying with strong kerosene emulsion and burning badly infested trees. It is stated that the gypsy moth and San José scale have not yet appeared in the State, but on account of their proximity and destructiveness in neighboring States notes are given upon them.

Insects affecting late cabbage, notes on the stalk borer, and insecticides (*New York State Sta. Bul. 83, pp. 657-688, pls. 2*).—This consists of notes on the appearance, life history, food plants, natural enemies, and treatment of the imported cabbage butterfly (*Pieris rapæ*), cabbage plusia (*Plusia brassicæ*), cabbage plutella (*Plutella cruciferarum*), cabbage aphis (*Aphis brassicæ*), green fly (*Rhopalosiphum dianthi*), onion thrips (*Thrips alii*), harlequin cabbage bug (*Murgantia histrionica*), zebra caterpillar (*Mamestra picta*), cabbage pionea (*Pionea rimosalis*), Southern cabbage butterfly (*Pieris protodice*), and the stalk borer (*Gartyna nitela*). In addition are given formulas and directions for applying Paris green or London purple and lime wash, "gypsine" (arsenate of lead), kerosene and soap emulsion, kerosene and milk emulsion, resin wash, bisulphid of carbon, tobacco, and hot water.

The cabbage butterfly is stated to produce from 4 to 5 broods annually on Long Island, the eggs being found as late as November 19. Experiments are cited with spraying infested plants with arsenical mixtures, combinations of Paris green and London purple with lime wash being employed. The results were satisfactory, the caterpillars being killed, while the plants were not injured. Dusting the plants with a mixture of 1 part of arsenical to 15 parts flour resulted in a slight burning of the leaves. The application of the arsenicals in the wet form is recommended. A list of unsatisfactory remedies is given, among them being road dust, decoctions of various herbs, pyrethrum, kerosene emulsion, etc. Two parasites are mentioned as efficient in destroying cabbage caterpillars, *Apantales glomeratus* and *Pteromalus puparum*. On account of the pupa case of *Apantales glomeratus* having been frequently mistaken for the egg of the cabbage butterfly and destroyed in consequence, photomicrographs of the two are given for the purpose of distinguishing them.

Experiments were made with a bacterial disease of the caterpillar to ascertain if the caterpillars could be inoculated from artificial cultures and the disease thus introduced among them. Boullion cultures of the bacterium (Micrococcus) were made and both pieris and plusia were inoculated. In one experiment the pieris larvæ were dead in 5 days. Some other experiments were not so successful, and the progress of the experiment was finally interfered with by a virulent epidemic of the disease in the fields. The experiments are to be continued. Planting turnips, radishes, or other plants of the families which blossom early in the season is advised for the purpose of attracting the cabbage butterflies, when they may be caught with nets and destroyed before they have laid their eggs on the cabbage plants.

The cabbage plusia is considered to do more damage to late cabbage than the cabbage butterfly, but the injury done by it is usually ascribed to the caterpillar of the latter insect. It is believed that there are 3 broods each year, feeding on various plants. Applications of strong mixtures of arsenites is urged. It was noticed that during cold, wet

weather in the fall the caterpillars were attacked by a disease that proved very virulent, the nature of which has not yet been discovered.

The cabbage plutella was present during the fall, but not in injurious numbers, nor is damage anticipated this year. It is believed to be 3-brooded, and arsenical treatment is recommended.

Experiments with bisulphid of carbon and some other insecticides were carried on against the cabbage aphis, the carbon bisulphid being poured into a covered pit in which cabbage heads were placed and left for 3 days. The lice were destroyed, while the heads were not injured. On growing plants kerosene emulsion diluted 10 times is recommended, applied to both the lower and upper sides of the leaves. Against the green fly, which was present in some numbers on Long Island, are recommended tobacco dust and tobacco fumes. The fungus disease *Empusa aphidis* was found to destroy about two-thirds of the insects noticed.

The onion thrips was found to be attacking cabbages in July, being considered a "rust" by farmers, and injuring principally the outer leaves. Spraying with kerosene emulsion was employed, but was not altogether satisfactory because of the difficulty in reaching all parts of the leaves. The insect is figured and an engraving from a photograph of a cabbage leaf attacked by it is presented.

The harlequin cabbage bug was present on cabbages, though it inflicted but slight injury. Hand picking the bugs is the only remedy suggested.

The stalk borer was injurious on the edges of a cornfield, affecting the first 3 or 4 rows next to fences grown up with weeds and underbrush. Clean farming is advised as a preventive.

The elm leaf beetle (*Connecticut Storrs Sta. Bul. 11, pp. 8, fig. 1*).—This consists of illustrated descriptive notes on the life history, habits, ravages, and treatment of *Galeruca xanthomelæna*, and is compiled from information given by the Division of Entomology of this Department, and also from Bulletin 103 of the New Jersey Station (E. S. R., 6, p. 649). The pest was very destructive in 1894 in the southwestern portion of Connecticut, many elms being entirely defoliated by the ravages of the larvæ, and disastrous spreading of the insect is feared. The life history and habits are given at length in order that the insect may be readily recognized and the importance of treatment appreciated. Spraying with Paris green the last of May and the first of June is advised as the best treatment, the pupæ to be destroyed in July by pouring kerosene emulsion or hot water on the ground about the base of the trees where the pupa stage is passed. The process of "tree inoculation" by means of introducing some bitter substance into the sap, for the purpose of deterring larval attacks upon the leaves, is not considered feasible.

Cineraria or marguerite fly, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Gardeners and Fruit Growers No. 4, pp. 3, figs. 4*).—Notes on *Phytomyza nigricornis*, the maggots of which were injurious to cine-

raria and marguerite plants by tunneling in the leaves and eating out the fleshy part. Although the cinerarias suffer most, other garden and wild plants are also attacked. Preventive measures are recommended as preferable to remedial ones, it being advised that plants be sprayed with arsenites or tar water to prevent the fly laying her egg. Immersing the infested plants in water is recommended for the purpose of drowning the larvæ.

Report of the entomological division (*Massachusetts Hatch Sta. Rpt. 1894, pp. 7, 8*).—Brief remarks on the work carried on by this division during the past year, in great part consisting of experiments with insecticides.

Paris green and lime, arsenate of soda, and arsenate of lead were employed against the gypsy moth and tent caterpillar, arsenate of lead giving the best results and being recommended for the purpose.

Study of cranberry insects was also carried on. An imported bark louse (*Orthezia insignis*) appeared in the station plant house and elsewhere, and it is feared may become troublesome.

Some new bees of the genus Perdita, T. D. A. COCKERELL (*Proc. Phila. Acad. Sci. 1895, I, pp. 11–19*).

The occurrence of parthenogenesis in bees, with comments on its bearing upon apiculture, R. HELMS (*Agl. Gaz. N. S. W., 6 (1895), No. 3, pp. 191–198*).

The space required by silkworms, F. LAMBERT (*Bul. Min. Agr. France, 14 (1895), No. 3, pp. 324–339*).

A few points on collecting Ichneumonidæ, G. C. DAVIS (*Canadian Ent., 27 (1895), No. 6, pp. 160, 161*).—Some general popular directions for collecting and breeding these parasitic insects.

Descriptions of new species of Australian Coleoptera, A. M. LEA (*Proc. Linn. Soc. N. S. W., 9 (1895), No. 4, pp. 589–634*).

On the Diptera of Baja, California, and some species from adjacent regions, C. H. T. TOWNSEND (*Proc. Cal. Acad. Sci., 4 (1895), No. 2, pp. 593–620*).

The coffee borer, G. RICHTER (*Proc. Agr. Hort. Soc. Madras, 1894, Jan.–Mar., pp. 79–82*).—A popular account of experiments with larvæ of *Xylotrechus quadrupes* taken from coffee and similar borers affecting the honny tree (*Pterocarpus marsupium*), the writer wishing to ascertain if the borers were the same species and if they would thrive equally well in either plant. The coffee borers did not thrive in the honny wood, although the honny borers did well in coffee branches.

Caterpillars attacking cocoa trees (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895) No. 1, pp. 1–5*).—Some general notes on a threatened attack, hand picking being advised.

Insect enemies and fungus diseases of crops, HOLLRUNG (*Deut. landw. Presse, 22 (1895), Nos. 43, pp. 404, 405, figs. 9; 44, pp. 413, 414; 46, p. 431, figs. 4*).—These articles are from the report of the Halle station for the repression of nematodes and for plant protection.

An enemy of the larch on the High Alps, H. CHRIST (*Garden and Forest, 8 (1895), No. 381, pp. 238, 239*).—A discussion of the ravages of *Steganoptycha pinicolana*, the caterpillars of which extensively skeletonize the larch leaves in the more open forests, not being found in the dense wood lands.

New facts about scale insects, I, T. D. A. COCKERELL (*Garden and Forest, 8 (1895), No. 382, p. 244*).—Discusses the ease with which they are overlooked, and the number of species being described as new.

Coccidæ or scale insects, T. D. A. COCKERELL (*Bul. Jamaica Bot. Gardens, 2 (1895), No. 5, pp. 100–102*).

The San José or pernicious scale (*New York State Sta. Bul. 87, pp. 122–132, figs. 2*).—This is a popular bulletin on *Aspidiotus perniciosus* compiled from various publications on the subject by stations and this Department. Caustic winter washes, oily washes, and fumigation with hydrocyanic acid gas are recommended as treatment and formulas are given for the preparation of kerosene emulsion; whale oil soap wash; potash and soda wash; lime, sulphur, and salt wash; and a resin wash.

Pear and cherry slug, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Gardeners and Fruit Growers No. 1, pp. 3, figs. 6*).—Notes on *Selandria cerasi*, giving the life history and habits and recommending spraying with an infusion of hellebore. Dusting with some fine powder, such as ashes, lime, etc., is also recommended, or spraying with a mixture of hellebore infusion and Paris green.

The cabbage moth, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Gardeners and Fruit Growers No. 3, pp. 3, figs. 8*).—Illustrative descriptive notes on *Plutella cruciferarum*, the life history, habits, and treatment being given. Dusting with gas lime or spraying with coal-tar water is recommended.

The potato grub, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 16, pp. 3, figs. 8*).—Notes on *Lita solanella*, which has been proving quite destructive to potatoes in New Zealand, burrowing numerous galleries in the tubers. Rotation of crops is recommended, destroying infested potatoes, and applying air-slacked lime to the land. The insect is considered to be a native either of Tasmania or New Zealand.

The Hessian fly, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 14, pp. 8, figs. 9*).—Popular notes on *Cecidomyia destructor* and a history of its attacks in the Colony, where it has been present for 15 years. It is believed that the attack, which was quite severe, is subsiding, the insects being reduced in number by parasites imported from England.

The crane fly, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 15, pp. 2, figs. 4*).—Notes on *Tipula* sp., the grubs of which have been doing damage to corn and grass lands in the colony, especially in wet land during moist seasons. Drainage, clean cultivation, rolling the ground at dusk, and top dressing with gas lime or salt are recommended as remedies.

Monograph of insects injurious to sugar cane and their enemies, D. DE CHARMOY (*Rev. Agr. Île Maurice, 9 (1895), No. 4, pp. 92–95*).

Report of entomologist, C. V. RILEY (*Maryland Sta. Rpt. 1894, pp. 190, 191*).—A brief report on the work pursued by the station entomologist during the year and the insects especially injurious throughout the State, the strawberry weevil (*Anthonomus signatus*), grape scale (*Aspidiotus uvæ*), San José scale (*A. perniciosus*), pear tree psylla (*Psylla pyri*), and peach scale (*Lecanium persicæ*) receiving particular mention. A bulletin on these and other injurious insects is in course of preparation.

Bibliography of the more important contributions to American economic entomology, IV, S. HENSHAW (*U. S. Dept. Agr., Division of Entomology, pp. 167*).—This consists of an alphabetical list, by authors, of the more important writings of Government and State entomologists and of other contributions to the literature of American economic entomology. Brief annotations give the scope of the papers listed. This part comprises the authors from A to K, inclusive.

Studies in Australian entomology, VII, T. G. SLOANE (*Proc. Linn. Soc. N. S. W., 9 (1895), No. 3, pp. 393–455*).—Descriptions are given of new genera and species of Carabidæ.

A manual for the study of insects, J. H. and A. B. COMSTOCK (*Ithaca, N. Y.: Comstock Publishing Co., 1895, pp. 701*).

A new fungicide (*Rev. Sci., ser. 4, 3 (1895), No. 25, p. 795*).—An account is given of a new fungicide made by the following formula: Sulphate of copper, 500 gm., cresonaphte 0.5 liter, and water 100 liters. It is to be sprayed twice in the season, and besides being a good fungicide it has strong insecticidal powers.

FOODS—ANIMAL PRODUCTION.

Methods and results of investigations on the chemistry and economy of food, W. O. ATWATER (*U. S. Dept. Agr., Office of Experiment Stations Bul. 21, pp. 222, figs. 15, charts 3*).—The object of this bulletin is "to summarize some of the results of late inquiry as to the physiological and pecuniary economy of food, and to indicate questions now demanding study and desirable methods of investigation." It contains information, largely compiled, on the following general subjects: Food and its use for nutriment, comparison of food materials, digestibility of food, preparation of food, use of food in the body—metabolism, fuel value of food, calorimetry, respiration apparatus, respiration calorimeter, pecuniary economy of food, food consumption and dietary studies, dietary standards, and errors in our food economy. The methods of food investigation, as dietary studies, digestibility, and calorimeter work, are described in considerable detail, and a number of lines for work are pointed out.

The kola nut, G. LE BON (*U. S. Consular Rpt. 1895, Apr., pp. 537–540; trans. from Rev. Sci.*).—This article gives the results of the writer's experience with the kola nut as a stimulant to prevent fatigue from severe physical exercise. The fresh nut was found to stimulate the bodily powers to a remarkable degree, although dried nuts were lacking in this respect. Analyses of the nut showed 2.35 per cent caffein and 0.023 per cent of theobroma, besides 1.3 per cent of a red glucosid, which after mastication was transformed in great part into caffein. Experiments with caffein and with theobroma indicated that neither alone possessed sustaining powers equal to the kola nut, while if they were used combined in proportions similar to those in which they occur in the nut, results very similar to those produced by the use of the nut were attained. It is believed that the kola nut is of extreme importance as a muscular stimulant when used in a fresh, unadulterated state.

Poultry foods (*Connecticut State Sta. Bul. 120, pp. 15, 16*).—Analyses are given of Bradley's Superior Meat Meal, Bowker's Animal Meal, Breck's Poultry and Swine Meal, Bartlett's OK Feed, and Smith & Romaine's Boiled Beef and Bone.

"All the preparations appear to consist chiefly of meat and bone having about the composition of 'bone tankage' which is used as a fertilizer.

"They are quite alike in composition, excepting that Breck's Poultry and Swine Meal contains less protein and phosphate of lime than any of the others and correspondingly more moisture and mineral matters which consist in part of carbonate of lime."

Action of mustard and pepper on digestion, GOTTLIEB (*Verhandl. Natur. med. Verein, Heidelberg, 5; abs. in Chem. Centbl., 1895, I, No. 7, p. 391*).—The author observed the constant and regular secretion

of the pancreatic juice by means of a canulà introduced into the pancreatic duct of a rabbit. This secretion was 3 or 4 times as large when small quantities of mustard or pepper were introduced into the stomach. The juice secreted under these conditions was somewhat more watery than normally, but possessed the same digestive properties.

A method of rendering straw more digestible, LEHMANN (*Landw. Jahrb., 24 (1895), Sup. I, pp. 118, 119*).—A sample of oat straw and one of wheat chaff were treated with hot sodium hydrate, the alkali neutralized with hydrochloric acid, and the digestibility of the treated material determined. The results, as compared with untreated material, were as follows:

Digestibility of treated and untreated oat straw and wheat chaff.

	Dry matter.	Protein.	Fat.	Ash.	Crude fiber.	Nitrogen-free extract.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
Oat straw:						
Untreated	37.3	6.2	24.8	36.1	42.0	36.3
Treated	62.9	....	48.8	39.5	79.0	64.8
Wheat chaff:						
Untreated	26.2	6.3	34.2	0.5	37.0	29.2
Treated	56.5	....	20.0	....	83.4	68.0

It will be seen that the treated material was far more digestible than the untreated, especially the fiber and nitrogen-free extract.

The method is not practical on account of the quantity of reagents required, but the result is of scientific interest in showing that it is the incrusting substances which are firmly combined with cellulose which prevent in a large degree the solution of the constituents of coarse fodders in the intestines of ruminants. When this union is dissolved the coarse fodder becomes a highly digestible substance, comparing in digestibility with concentrated feeding stuffs, except in regard to protein.

Silage of flint, sweet, southern, and dent corn compared, W. M. HAYS (*Minnesota Sta. Bul. 40, pp. 238–241*).—In a comparison of silage from flint, southern, and dent corn 2 lots of cows were fed in 3 periods of 21 days each, with preliminary periods of about 7 days. Dent corn was fed during the first and third periods to both lots; and during the second period lot 1 had silage from Southern Ensilage corn and lot 2 silage from flint corn. The same grain ration was fed throughout. Another comparison of silage from dent and from southern corn was made on 6 native cows during 3 twelve-day periods. In another trial silage from sweet corn and from dent corn were compared on 2 cows.

The results of these several trials are tabulated, showing the amounts of food eaten and the milk and butter fat produced. Following is the author's summary:

"(1) A hundred pounds of dry matter in either dent, sweet, or Southern Ensilage corn silage proved nearly of equal value for producing milk and butter in these trials, though the advantage in all cases was slightly in favor of the silage of dent corn. This corn bore a fair crop of ears.

"(2) Flint-corn silage did not prove as good in this one trial for producing milk and butter as dent-corn silage.

"(3) Cattle did not seem to relish silage of flint corn as well as silage of the other 3 classes of corn.

"(4) Where a large amount of silage is wanted from a small area of land to feed with cheap mill feeds, these results would indicate that the most feed can be procured by using, in any given locality, corn so large that it will barely pass the roasting-ear stage before frosts. Here large field corn from the latitude of Missouri would probably make the most feed per acre."

Cotton-seed meal vs. soja-bean meal for cows (*Massachusetts Hatch Sta. Rpt. 1893, pp. 13, 14*).—A brief report on an experiment to compare cotton-seed meal and soja-bean meal on 2 lots of 4 cows each in alternating periods of 3 weeks.

"The cows on the soja-bean meal gave rather the most milk. . . .

"The cotton-seed butter was of firmer texture than the other, but was, by the verdict of three families working independently and without knowledge of the nature of the difference between the samples, decidedly inferior to that made from the soja-bean cream. The latter was of a higher color and much more agreeable texture and flavor. The cotton-seed butter had a greasy feeling in the mouth, while the other was of agreeable texture.

"A larger percentage of the total fat in the milk was recovered in the cream from the cows fed on cotton-seed meal than in the cream from those fed on bean meal.

"It would appear from this experiment that the soja-bean meal is superior to cotton-seed meal as a food either for milk or butter production. If further work establishes this conclusion, it lies within the power of Massachusetts farmers to raise the concentrated nitrogenous food needed for their animals."

Effect of food on milk—feeding with fats, A. H. WOOD (*New Hampshire Sta. Bul. 20, pp. 8*).—In this experiment, lasting from March 3 to July 4, 3 cows were used. Previous to the experiment the cows had been receiving a ration of corn silage, mixed hay, oat hay, and a mixture of equal parts of cotton seed, gluten meal, and middlings, furnishing a nutritive ratio of 1:6. For the first 2 weeks the cows received a basal ration of corn silage, clover hay, vetch hay, ground oats, and middlings, having a nutritive ratio of 1:5.9. In 3 subsequent periods of 2 weeks each palm oil, cotton-seed oil, corn oil, oleo oil, cocoanut oil, and stearin were fed to different cows at the rate of 12 oz. per 1,000 lbs. of live weight. At the beginning of the third period clover hay was substituted for the vetch hay, slightly widening the nutritive ratio. In the second period when corn oil was being fed to one of the cows the supply of oil gave out at the end of 10 days and the cow was returned to the basal ration. One of the cows went off feed in the third period while receiving cocoanut oil and was dropped. Following the feeding of oil the cows were returned to the ordinary ration for 1 month and then turned to pasture.

The milk of each cow was analyzed daily, and at the close of each period the milk from each cow was separated with a hand separator and the cream churned while still sweet and made into butter. The hardness of the butter was determined by Parsons's method.[1] Deter-

[1] E. S. R., 3, p. 86.

minations of the fat in the skim milk and buttermilk are given. The average results for each period are given in the following table:

Results of feeding oils to milch cows.

Period.	Rations.	Nutritive ratio.	Average daily yield of milk.	Average composition of milk. Fat.	Average composition of milk. Casein.	Average amount of fat in milk per day.	Hardness of butter (penetration of glass rod.)
			Pounds.	*Per cent.*	*Per cent.*	*Pounds.*	*Millimeters.*
	Duchess:						
	Ordinary	1:6	29.15	4.10	3.14	1.20	....
1	Basal	1 5.9	27.68	4.43	3.20	1 23	15.0
2	Basal + palm oil	1:6 8	28.81	4.52	3.03	1.30	14.0
3	Basal+stearin	1.6.9	29.19	4.41	3.01	1.29	13.5
4	Basal + cotton-seed oil	1 6.9	29.43	4.11	2.99	1.21	17.0
5	Ordinary	1 6	32 33	4 07	3.01	1.32	14.0
6	Pasture	....	30.23	4.58	3.16	1.38	....
	Princess Leto:						
	Ordinary	1.6	19.37	5.12	3.22	.99	....
1	Basal	1:5.9	20 38	5.18	3.53	1.06	7.5
2	Basal + corn oil	1 6 8	20 52	5.48	3.27	1.12	9.0
	Basal	1 5.9	20.68	5.24	....	1 08	7.0
3	Basal + oleo oil	1 6 9	21.58	5.19	3.35	1.11	6.5
4	Basal + cocoanut oil	1·6.9	20.67	5.31	3.40	1 10	5.7
5	Ordinary	1 6	22.55	4.89	3 29	1.10	8.0
6	Pasture	....	20 81	4.90	3.31	1.02	....
	Maramee.						
	Ordinary	1 6	23.35	3 29	2.58	0.77	....
1	Basal	1 5.9	23 82	3.22	2 89	0.77	16.0
2	Basal + cotton seed oil	1 6 8	21.04	3.47	2 71	0.83	15.5 29.0
3	Basal + cocoanut oil	1 6.9	20 74	3.08	2.38	0.64	....

"It would seem that the first effect of feeding oils was to increase the fat in the milk. Princess, in period 1, averaged 5.18 per cent; with the addition of corn oil her average for 10 days was raised to 5.48 per cent, an increase of 0.3 per cent. Omitting the oil her average for the next 5 days fell to 5.21 per cent. Had similar results been reached with the other cows, as probably would have been the case had they all returned to Ration A (basal) and the experiment stopped at this point, it might have been said that it had been proven that adding fat to the ration increased the fat in the milk. But we notice that the sharp increase in fat was followed by a decrease, until the milk again nearly reached its normal condition. In period 2, with palm oil, Duchess gave milk with 4.52 per cent of fat; in period 4, with cotton-seed oil, it fell to 4.11 per cent. We can not say that this change was due to the change in oils, for in period 2 Maramee, with cotton-seed oil, increased the fat in her milk 3.22 to 3.47 per cent.

"The addition of these oils to the cows' rations produced no objectionable qualities in the butter product. With respect to hardness there are two variations that should be noticed: (1) The softening of the butter from Princess Leto when upon corn oil. The change was noticeable, not alone in the butter, but in its quick churning. This change seems to be an explanation of the difference in the hardness of butters from corn meal and gluten, which is a by-product of corn. Corn meal contains about 4.50 per cent of this oil, while the gluten from which we have obtained soft butters contains about 18 per cent, or 4 times as much as the corn meal. (2) The softening of the butter of Duchess when upon cotton-seed oil. With Maramee upon cotton-seed oil we got very unsatisfactory results, one sample taken March 27 showing very little variation from her previous butters, while another sample taken 4 days later proved to be remarkably soft. If it prove true, on further investigation, that cotton-seed oil does soften butter, it will show that cotton seed and its meal contain something that not only offsets the tendency of its oil, but gives to the butter product of the cows fed upon it a remarkably firm texture. . . .

"Now, in conclusion, I think that I may say that this experiment indicates—

"That the first effect of an increase of fat in a cow's ration is to increase the per cent of fat in her milk;

"That with the continuance of such a ration, the tendency is for the milk to return to its normal condition;

"That the increase in fat is not due to the oils but to the unnatural character of the ration;

"That the results in this experiment tend to confirm the conclusions expressed in previous bulletins from this station, that the composition of a cow's milk is determined by the individuality of the cow, and that although an unusual food may disturb for a time the composition of the milk, its effect is not continuous."

Feeding milch cows, J. H. CONNELL and J. CLAYTON (*Texas Sta. Bul. 33, pp. 499–520*).—Four feeding trials are reported, which were made to compare a number of different rations for milk production. In the first 2 trials 2 lots of 4 cows each were used, and in the last 2 trials 5 lots of 3 cows each. In the first 2 the grain was constant, and alfalfa, cotton-seed hulls, silage, and hay were each fed to a different lot, the rations for each lot being the same in both experiments. In the last 2 trials cotton-seed meal, corn meal, and boiled cotton seed were fed in cotton seed hulls, alfalfa, or hay, the rations for the different lots being unchanged throughout.[1] For each experiment the amounts of food eaten, the milk and butter produced, and the financial results are tabulated. It appears that in the first 2 trials the lot receiving alfalfa and grain gave the largest yield of milk. In the last 2 trials "cotton-seed meal produced more milk than did the cotton seed, but the cost of the meal ration was so much more than the cotton-seed ration that the net profit is much in favor of the cotton seed."

The bulletin concludes with 14 suggested rations for the South, and some general suggestions for feeding.

"We do not advise the combination of cotton-seed meal with prairie hay alone for milch cows, although there are some conditions under which it should be fed.

"Cotton-seed hulls when combined with corn meal do not produce a large milk flow, but increase the live weight rapidly.

"Cotton-seed hulls should not be fed continuously as sole forage to milk cattle.

"Corn silage always cheapens the cost of the forage ration, but in the experiments here reported on too little food was eaten by the groups fed silage to permit a good flow of milk. The cows in these groups were 'off their feed' the greater part of the test."

The secretion of milk, F. W. MORSE and E. P. STONE (*New Hampshire Sta. Rpt. 1893, pp. 140–142*).—Two new-milch Durham cows soon after calving were milked 3 times a day from February 1 to May 6, the specific gravity and fat being determined, and the solids-not-fat calculated. The hours of milking were 5.30 a. m., noon, and 6.30 p. m. The maximum, minimum, and average composition of the milk of each cow for the morning, noon, and night milking, and the yield of milk, are given for the period from February 1 to 14.

"A study of the composition of the milk shows that the morning milk was richest in solids-not-fat, and poorest in fat; while the noon milk was richest in fat.

[1] It will be seen that each lot was fed a different ration throughout, that the lots were not reversed, and that at no time were they all fed a uniform ration, so that we have no basis for making a proper comparison of the different rations.—ED.

"The yield of milk in the morning was 44 per cent of the total, and 78 per cent of the sum of noon and night milk. The yield at night was less than at noon, and averaged less in fat also."

After May 6 the cows were milked only twice daily. For 3 days before and after the change was made composite samples were made each day and the fat determined. The average results were as follows:

Results of milking twice and thrice daily.

	Yield of milk.	Fat.
Duchess:	*Pounds.*	*Per cent.*
Milked three times	34.6	4.39
Milked twice	33.8	3.97
Duchess II:		
Milked three times	39.3	4.08
Milked twice	38.8	3.93

"There was no notable change in the amount of milk, but there was a decrease in the fat.

"The results of these experiments show that in the short milking periods there was relatively more fat produced than in the long one, while the solids-not-fat did not increase. Milking 3 times a day also caused a greater secretion of fat than was produced by milking twice a day."

The feeding value of straw and chaff, LEHMANN (*Landw. Jahrb., 24 (1895), Sup. 1, pp. 112-115*).—At the Göttingen Station 68 separate experiments have been made with 10 sheep on the digestibility of oat straw. In these the straw was not fed alone but with grain, and the digestibility of the grain was determined in separate periods. For instance, in one set of experiments where the grain was coarsely ground beans the rations were as follows:

Rations fed in digestion experiment.

	Sheep No. 1.	Sheep No. 2.	Sheep No. 3.	Sheep No. 4.
Period 1:				
Oat straw	500	400	300	300
Ground beans	300	300	300	300
Salt	10	10	10	10
Period 2:				
Oat straw	500	400	300	300
Ground beans	500	500	500	500
Salt	10	10	10	10
Period 4:				
Rowen hay	800	800	600	600
Ground beans	250	250	250	250
Salt	10	10	10	10
Period 5:				
Rowen hay	1,000	1,000	800	800
Salt	10	10	10	10

In other experiments the grain was a mixture of corn meal and cotton-seed meal.

The results obtained in different experiments are given as follows:

Digestion coëfficients for oat straw fed to sheep.

Dry matter.	Crude protein.	Fat	Ash.	Crude fiber.	Nitrogen-free extract.
Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
34.7	2.7	36.0	34.1	39.0	33.6
38.7	−0.8	24 5	35 8	44.2	38.2
37.6	7.9	36.0	41.0	39.2	37.8
36 6	−3.3	19.1	30.9	43.1	35 9
38 8	24 3	8 2	38 5	44.4	35 8
Av..37.3	6 2	24.8	36.1	42.0	36.3

Four experiments with wheat straw fed to sheep in connection with coarsely ground beans gave the following digestion coëfficient for the straw:

Digestion coëfficients for wheat straw fed to sheep.

	Dry matter.	Crude protein.	Fat.	Ash.	Crude fiber.	Nitrogen free extract.
	Per cent.	*Per cent*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
Sheep 1 and 2	34.7	−7.3 6	24 0	11.2	44.6	34.7
Sheep 3 and 4	36 3	−19.1	15.6	5 8	45.4	36.3
Average	35 5	....	19.9	8 5	45.0	35.5

It appears that these coëfficients for oat and wheat straw are considerably lower than those given by Dietrich and König, but correspond with many found in the last 10 years. The author is inclined to believe that although the straw fed in these trials appears to be lower in feeding value than that for which we have data, it corresponds in quality to most of the straw grown at present, and he plans to investigate this point further.

Digestion experiments with 2 sheep on oat and wheat chaff are reported, which are said to be the first digestion trials made on chaff. The results follow:

Composition and digestibility of oat and wheat chaff.

	Protein.	Fat.	Ash.	Crude fiber.	Nitrogen free extract.	Dry matter.
Composition of dry matter:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Oat chaff	6.88	2.14	13.50	26.90	50 54	100.00
Wheat chaff	4.00	0.94	16.86	34.24	43.93	100.00
Digestibility:						
Oat chaff	38.10	48.40	11 10	44.70	48.70	41.8
Wheat chaff	26.30	34.20	0.50	37.00	29.20	26.2

The results are regarded as surprising. They show a wide difference between oat and wheat chaff. While oat chaff is more digestible than oat straw, wheat chaff is inferior to wheat straw in this respect and much inferior to oat chaff.

Compilation of analyses of cattle foods, grasses, and forage crops, E. P. STONE (*New Hampshire Sta. Rpt. 1893, pp. 135, 136, 138, 139*).—A compilation of analyses made at the station since its organization, including corn meal, cotton-seed meal, cotton seed, gluten feed, gluten meal, malt sprouts, wheat bran, wheat middlings, hay, millet, silage, alsike clover, red clover, blue grass, orchard grass, reed meadow grass, redtop, timothy, witch grass, Hungarian, common millet, golden millet, winter rye, soja bean, vetch, sainfoin, burnet, buttercup, oxeye daisy, and sorrel.

German and Russian rye, II and III, M. FISCHER (*Fühling's landw. Ztg., 44 (1895), Nos. 10, pp. 297–308; 11, pp. 329–333*).—The results of investigations of the composition and baking qualities of rye from different sources.

The utilization of sugar-beet molasses, M. HOLLRUNG (*Fühling's landw. Ztg., 44 (1895), Nos. 10, pp. 315–318; 11, pp. 341–345*).—These articles treat of the proper amount of molasses to feed to different classes of stock and of the manner of feeding this by-product.

Food mixtures containing molasses, G. VIBRAUS (*Deut. landw. Presse, 22 (1895), No. 42, p. 392*).

Utilization of bananas for meal (*Bul. Jamaica Bot. Gardens, 2 (1895), No. 5, pp. 98, 99*).

Maize and maize meal—studies on a new milling process, W. BERSCH (*Oesterr. ungar. Ztschr. Zuckerind. und Landw., 24, p. 839; Centbl. agr. Chem., 23, p. 691; abs. in Ann. Agron., 21 (1895), No. 5, p. 238*).

An improved method and device for sterilizing victuals, beverages, remedies, and the like, J. BASSFREUND (*Jour. Soc. Chem. Ind., 14 (1895), No. 5, p. 500*).—Patented methods and apparatus.

Cattle breeding, J. L. THOMPSON (*Agl. Gaz. N. S. W., 6 (1895), No. 3, pp. 199–204*).—A popular paper.

The Fribourg breed of cattle, H. GEORGE (*Jour. Agr. Prat., 59 (1895), No. 25, pp. 895–898, pl. 1*).

Slaughter experiments at the fat stock show in Berlin, 1895, C. LEHMANN (*Deut. landw. Presse, 22 (1895), No. 40, pp. 377, 378*).

The use of potatoes in feeding animals, A. GIRARD (*Prog. Agr. et Vit., 12 (1895), No. 22, pp. 585–589*).

Stock feeders' guide, with chart, G. H. WHITCHER (*New Hampshire Sta. Rpt. 1893, pp. 106–118, fig. 1*).—A reprint from Bulletin 17 of the station (E. S. R., 4, p. 665).

Effect of food on the composition of butter, F. W. MORSE (*New Hampshire Sta. Rpt. 1893, pp. 87–97*).—A reprint from Bulletin 16 of the station (E. S. R., 4, p. 662).

Experiments in feeding for milk and butter, A. H. WOOD (*New Hampshire Sta. Rpt. 1893, pp. 118–130*).—A reprint from Bulletin 18 of the station (E. S. R, 5, p. 668).

Various oils used in rations, F. W. MORSE (*New Hampshire Sta. Rpt. 1893, pp. 98–106*).—A reprint from Bulletin 16 of the station (E. S. R., 4, p. 662).

Influence of the cooling of eggs on the number hatching, A. DIEUDONNE (*Bul. Min. Agr. France, 14 (1895), No. 3, pp. 317–323*).—A popular article.

Poultry as a profitable adjunct to fruit growing, C. E. CHAPMAN (*North Carolina State Hort. Soc. Rpt. 1894, pp. 15, 16*).—A general article on the subject of poultry raising, and directions for care, feeding, etc.

VETERINARY SCIENCE AND PRACTICE.

Dehorning cattle (*Tennessee Sta. Bul., Vol. VII, No. 4, pp. 169–174*).—Twenty cows and 8 heifers of the station herd were dehorned in December, 1894. Mild weather in winter is regarded as the best time for dehorning. The use of a strong stanchion and a Keystone dehorner so adjusted as to cut one-eighth inch of the skin with the horn, and

the application of a handful of dry flour on each cavity are recommended. Tabulated data give the milk records and temperatures before and after dehorning, and show a slight rise of temperature, but no decrease in the yield of milk as the result of dehorning. The use of caustic potash on calves between 12 and 20 days old is recommended as a means of preventing the growth of horns.

A case of anthrax in man, HITZIG (*Korrespondenz Schweiz. Aertze, 1895, p. 169; abs. in Centbl. Bakt. und Par. Med., 17 (1895), No. 18 and 19, p. 665*).

The diagnostic effect of mallein injections, FOTH (*Deut. tierarz. Wochenschr., 1895, No. 5, pp. 37-42; abs. in Centbl. Bakt. und Par. Med., 17 (1895), No. 18 and 19, pp. 693-694*).

On the preparation and composition of mallein (*Arch. sci. Biol. Inst. Imper. Med. St. Petersburg, I, No. 5, p. 711; abs. in Centbl. Bakt. und Par. Med., 17 (1895), No. 18 and 19, pp. 690-692*).

On the use of animal serum to prevent tetanus, L. VAILLARD (*Compt. Rend., 120 (1895), No. 21, pp. 1181-1183*).

Tuberculosis of domestic animals and its prevention, F. A. ZÜRN (*Die Tuberkulose der Hausthiere und deren Vorbeuge. Leipzig: Arthur Felix, 1895*).

Report on pneumobacillus liquefaciens bovis and pneumobacillin, S. ARLOING (*Bul. Min. Agr. France, 14 (1895), No. 3, pp. 249-271*).—An account of investigations conducted for the greater part by the author. The author considers that in the use of pneumobacillin as a diagnostic agent more careful and complete observations are required than is necessary with mallein and tuberculin.

On the mode of resistance of lower vertebrates to artificial microbic invasions, A. MESNIL (*Ann. Inst. Pasteur, 9 (1895), No. 5, pp. 301-351*).—A contribution to the study of immunity.

DAIRYING.

Iron in milk, FRIEDRICHS (*Inaug. Diss. Würzburg, 1893; abs. in Ztschr. Fleisch- und Milchhyg., 5 (1895), No. 7, p. 131*).—In human milk 1.1 mg. of iron per liter was found. Adding iron phosphate to the food did not increase the iron content of the milk. A goat fed hay, clover, and bran gave milk with 1.6 mg. of iron per liter. Here, also, the feeding of from 0.2 to 0.5 gm. of iron phosphate per day resulted in no appreciable increase in the iron content in the milk.

Abnormal butter, F. W. MORSE (*New Hampshire Sta. Rpt. 1893, pp. 152, 153*).—In connection with a feeding experiment 2 abnormal samples of butter were obtained, one from an Ayshire cow, 11 months in milk, which was receiving a ration of hay, silage, gluten meal, and cotton-seed oil; and the other from a Holstein cow, 13 months in milk, receiving a ration of hay, silage, and cotton-seed meal. Analyses of the samples gave the following results:

	Volatile acids.	Iodin number.
No. 1	16.5	39.6
No. 2	11.2	36.0

"The physical properties of the 2 samples would have caused them to be condemned by any consumer of butter, as they were very hard, pale in color, and with

an odor closely resembling that of tallow. The last property was especially noticeable in the second sample.

"There were, undoubtedly, two principal causes for these abnormal qualities and low figures for volatile acids; the advanced stages of lactation and the cotton-seed products in the food, as these have both been shown to depress the volatile acids; and the cotton-seed meal has been found to reduce the iodin number and raise the melting point of the butter fat.

"During our feeding experiments the figures for volatile acids have been found to vary between wider limits than those for the iodin number, both with individual cows and with all the analyses. The following results are from figures obtained with 9 individual cows and over 100 samples of butter: The widest range for volatile acids by an individual cow was 11.2 to 32.4, and the next widest was from 17.6 to 33.1. The widest range for the iodin number by an individual cow extended from 30.1 to 44.8, while 3 other cows had nearly as wide a range. The extreme limits for all analyses were 11.2 and 33.9 for volatile acids, and 24.2 and 44.8 for the iodin number.

"The minimum limit for volatile acids shown by these figures is so low that it is practically impossible to prove the presence of oleomargarine in butter by chemical means."

Water content of German butter (*Landw. Jahrb., 24 (1895), Sup. I, pp. 128–133*).—Some time since the Prussian Minister of Agriculture, Domains, and Forests requested the Prussian experiment stations to investigate the water content of butter, with a view to fixing a maximum content for normal butter (E. S. R., 5, p. 131). The results of some of these investigations have been previously noticed (E. S. R., 5, p. 952). The reports of work at a number of other stations are here added, being taken from the annual report of the Prussian stations.

At the Halle Station 23 samples of butter examined showed a range from 10.5 to 15.4 per cent of water, with an average of 12.9 per cent. At the Insterburg Station 40 samples were analyzed, classed as follows: 29 of ordinary market butter. 7 of creamery butter, and 3 from large estates. The water in the market butter ranged from 12.90 to 21.85 and averged 16.80 per cent; that in the creamery butter ranged from 12.01 to 16.47, and averaged 14.10 per cent; and that in the butter made at 3 large estates was 11.08, 12.40, and 13.31 per cent, respectively. The station at Köslin examined 120 samples, extending over 1 year. The range was from 8.62 to 19.13, and the average 12.35 per cent of water. The Königsberg Station examined 119 samples of what appeared to be normal butter from different sections with the following result: Minimum 8.49, maximum 17.97, average 12.51 per cent of water. A number of other stations mention that they are engaged in this work.

The mineral ingredients of cheese, G. MARIANI and E. TASSELLI (*Staz. Sper. Agr. Ital., 38 (1895), p. 23; abs. in Chem. Ztg., 19 (1895), No. 10, Repert., p. 114*).—The authors determined the ash constituents of 15 kinds of Italian cheese of various origin and found in every case the phosphoric acid to exceed the lime, varying from 1.07 to 1.75 parts of the former to 1 part of the latter, while in milk the opposite is the case. The relation between the lime and phosphoric acid is strikingly constant for the different varieties of cheese.—J. P. STREET.

Margarin cheese and its analysis, M. KÜHN (*Molk. Ztg.*, *9 (1895), No. 13, pp. 185–187*).—The history and description of "filled" cheese is given, and methods recommended for its analysis and detection. The percentage composition of the cheese is said to be of no value in distinguishing it from natural cream cheese, but it is recommended to make the following determinations in the ether extract of the cheese: (1) Specific gravity at 100° C. by means of Westphal balance and König's butter areometer; (2) insoluble fatty acids by the Hehner method; (3) volatile fatty acids by the Reichert Meissl-Wollny method; (4) Köttisdorfer saponification equivalent; and (5) angle of refraction in the Zeiss-Wollny butter refractometer. The results of examination of a number of filled cheeses are given in comparison with those for a genuine cream cheese.

The behavior of cholera bacilli in raw milk, F. BASENAU (*Arch. Hyg.*, *23 (1895), No. 2, pp. 170–183*).—The author reviews the literature on the subject of germicidal action of milk on cholera germs, and reports experiments by himself from which he draws the following conclusions:

(1) Raw milk has no germicidal properties for cholera bacilli, as was claimed by Hesse.[1]

(2) On the contrary, cholera bacilli retain their vitality in raw milk which is practically germ free for at least 38 hours, and they can continue to grow in it up to the time it curdles, and this at all temperatures within which the germs are capable of growth in any medium.

(3) They also remained alive for at least 32 hours in ordinary market milk which had from 350,000 to 500,000 germs per cubic centimeter at the beginning, when the milk was kept either at 37° C., 24°, or room temperature. They retained their vitality even after the milk was curdled.

On the question of the relation of casein to lactic fermentation, G. KABRHEL (*Arch. Hyg.*, *22 (1885), No. 4, pp. 392–396*).—A controversial article on the priority of the discovery and demonstration that casein is capable of combining chemically with the acid of lactic fermentation, thus enabling the microörganisms to continue their growth. Timpe[2] claims to have first demonstrated this. Although he admits that Kabrhel first suggested it, he contends that he failed to give satisfactory experimental evidence of it. Kabrhel, in the present article, cites his previous experiments on this matter, and insists that they show that the casein combines with the lactic acid formed in souring milk.

Results of investigation relating to the manufacture of cheese for the season of 1894 (*New York State Sta. Bul. 82, pp. 595–656*).—During 1894 experiments in cheese making were continued in coöperation with one cheese factory, the season covered being from May to

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[1] Ztschr. Hyg. und Infect. Kraukh., 17, p. 238; and Viertelj. öffentl. Gesundheitspflege, 26, p 652.

[2] E. R. S., 5, p. 814.

October. The milk delivered ranged from 8,643 to 14,232 lbs. per day, and aggregated 256,589 lbs. It was produced by 650 cows, largely natives, with some grade Ayrshires and Holsteins. The testing of the milk delivered at the factory was continued during October.

The data are summarized for the conditions of manufacture, the composition of the milk during the season, the relation of casein to fat and to albumen in normal milk, the composition of whey and of green cheese, the loss of constituents in cheese making, the relation of composition of milk to the yield of cheese, and the loss in weight of green cheese in 3 to 4 weeks after manufacture. The summary of the results for the season is given in the bulletin, from which the following is taken:

"*Conditions of manufacture.*—The amount of rennet extract used for 1,000 lbs. of milk varied from 3½ to 4½ oz. and averaged 3⅞ oz.

"The temperature of the milk when the rennet was added varied from 83 to 86° F. and averaged about 84° F.

"The time of coagulation varied from 25 to 45 minutes and averaged over 35 minutes.

"The degree of temperature to which the curd was heated after cutting varied from 99 to 101° F. and averaged 100° F.

"The time that passed between cutting the curd and drawing the whey varied from 2 hours and 35 minutes to 5 hours and averaged 3 hours and 43 minutes.

"The length of string formed on a hot iron when whey was drawn varied from ⅛ to ½ in.

"The time that passed between drawing the whey and putting the curd in press varied from 1 hour and 15 minutes to nearly 2 hours and 50 minutes and averaged about 1 hour and 50 minutes.

"The string on hot iron when curd was put in press varied in length from ½ to 2 in. and averaged about 1½ in.

"The temperature of the curd when put in press varied from 83 to 87° F. and averaged about 85° F.

"The time occupied by the operation of cheese making after adding the rennet varied from 4 hours to 7 hours and 15 minutes and averaged 6 hours and 16 minutes.

"*The composition of normal milk.*—

Composition of milk.

	Least.	Greatest	Average.
	Per cent	*Per cent.*	*Per cent.*
Water	86.61	87.71	87.38
Total solids	12.29	13.39	12.62
Fat	3.70	4.10	3.73
Nitrogen compounds	2.94	3.46	3.13
Casein	2.19	2.66	2.41
Albumen and albumose	0.58	0.88	0.72
Sugar, ash, etc.	5.58	6.03	5.72

"The amount of cheese-producing solids (fat and casein) in 100 lbs. of milk varied from 5.59 to 6.74 lbs. and averaged 6.14 lbs. during the season.

"The amount of whey solids (albumen, sugar, etc.) in 100 lbs. of milk varied from 6.33 to 6.73 lbs. and averaged 6.49 lbs. during the season.

"For each pound of albumen and albumose the casein varied from 2.80 to 4.34 lbs. and averaged 3.35 lbs. during the season.

"For each pound of fat the casein varied from 0.58 to 0.70 lb. and averaged 0.65 lb. during the season.

"*The composition of whey.*—

Composition of whey.

	Least.	Greatest.	Average.
	Per cent.	*Per cent.*	*Per cent.*
Water	92.86	93.25	93.12
Total solids	6.75	7.14	6.88
Fat	0.22	0.40	0.27
Nitrogen compounds	0.75	0.86	0.81
Sugar, ash, etc	5.61	6.08	5.80

"The amount of solids in 100 lbs. of whey varied during the season from 6.75 to 7.14 lbs. and averaged 6.88 lbs.

"The amount of fat in 100 lbs. of whey varied during the season from 0.22 to 0.40 lb. and averaged 0.27 lb.

"The amount of nitrogen compounds in 100 lbs. of whey varied during the season from 0.75 to 0.86 lb. and averaged 0.81 lb.

"*The composition of green cheese made from normal milk.*—

Composition of green cheese.

	Least	Greatest.	Average.
	Per cent.	*Per cent.*	*Per cent.*
Water	33.33	39.73	36.70
Total solids	60.27	66.67	63.30
Fat	31.42	36.12	34.18
Casein, etc	21.93	23.85	23.44
Sugar, ash, etc	3.17	7.60	5.68

"The amount of water in 100 lbs. of green cheese varied during the season from 33.33 to 39.73 lbs. and averaged 36.70 lbs.

"The amount of solids in 100 lbs. of green cheese varied from 60.27 to 66.67 lbs. and averaged 63.30 during the season.

"The amount of fat in 100 lbs. of green cheese varied during the season from 31.42 to 36.12 lbs. and averaged 34.18 lbs.

"The amount of casein, etc., in 100 lbs. of green cheese varied during the season from 21.93 to 23.85 lbs. and averaged 23.44 lbs.

"For each pound of casein, etc., in the cheese the fat varied from 1.35 to 1.56 lbs. and averaged 1.46 lbs. during the season.

"For each pound of solids-not-fat the fat varied from 1.04 to 1.27 lbs. and averaged 1.17 lbs. during the season.

"*Loss of milk constituents in cheese making.*—The amount of milk solids in 100 lbs. of milk that was lost in the whey in cheese making varied during the season from 6.09 to 6.39 lbs. and averaged 6.20 lbs.; this was equivalent to from 47.91 to 50.85 per cent of the solids in the milk, with an average of 49.52 per cent.

"The per cent of the solids in the milk lost in the whey diminished as the season advanced.

"The amount of fat in 100 lbs. of milk that was lost in the whey in cheese making varied during the season from 0.20 to 0.36 lb. and averaged 0.25 lb.; this was equivalent to from 5.55 to 9.73 per cent of the fat in the milk, with an average of 6.83 per cent.

"The proportion of fat in milk that was lost in cheese making was entirely independent of the amount of fat in the milk. The variations in loss were due either to the condition of the milk or to some special conditions employed in manufacture.

"The amount of nitrogen compounds in 100 lbs. of milk that was lost in the whey in cheese making varied during the season from 0.68 to 0.76 lb. and averaged 0.73 lb.; this was equivalent to from 22.53 to 25.17 per cent of the nitrogen compounds in the milk, with an average of 23.78 per cent.

"The proportion of nitrogen compounds lost in cheese making was, in general, very uniform and was little influenced by variations in the conditions of manufacture.

"*Influence of composition of milk on yield of cheese.*—From 100 lbs. of milk there were made during the season from 9.30 to 11.15 lbs. of green cheese, the average being 10 lbs.

"From 8.97 to 10.75 lbs. of milk were required to make 1 lb. of cheese, 10 lbs. being the average.

"The amount of water retained in the cheese made from 100 lbs. of milk varied during the season from 3.10 to 4.08 lbs. and averaged 3.68 lbs.

"The amount of fat retained in the cheese made from 100 lbs. of milk varied during the season from 3.19 to 3.63 lbs and averaged 3.41 lbs. The variation in the amount of fat retained in the cheese made from 100 lbs. of milk followed very closely the variation of fat in 100 lbs. of milk.

"The amount of casein, etc., retained in the cheese made from 100 lbs. of milk varied during the season from 2.21 to 2.51 lbs. and averaged 2.34 lbs.

"Each pound of fat produced from 2.51 to 2.98 lbs. of cheese, the average for the season being 2.72 lbs.

"*Loss of weight in cheese.*—The loss of weight for 100 lbs. of cheese between dates of manufacture and sale varied from 1.80 to 5.16 lbs. and averaged 3.40 lbs. for the season.

"The number of days between manufacture and sale of cheese varied from 18 to 28 and averaged 26½ days.

"The average daily loss of weight for 100 lbs. of cheese varied from 0.09 to 0.25 lb. and averaged for the season 0.155 lb., which is equivalent to 2½ oz. The average daily loss was quite uniform, whether cheese was kept 3 weeks or 4 weeks."

Butter and milk, F. W. MORSE (*New Hampshire Sta. Rpt. 1893, pp. 133-135*).—Analyses of 6 samples of butter and the morning's and night's milk of a sick cow, and a summary of the determinations of fat in 211 samples of milk.

Milk and dairy products, F. BAUMEISTER (*Milch und Molkerei-Produkte. Wien, Peste, Leipzig: A. Hartleben, 1895*).

The examination of fat and margarin cheeses, M. KUHN (*Chem. Ztg., 19 (1895), Nos. 25, p. 554; 27, pp. 601, 602; 29, pp. 648, 649*).—The author gives in detail his method of procedure in the examination of cheeses.

The digestibility of sterilized milk, E. DUCLAUX (*Ann. Inst. Pasteur, 9 (1895), No. 5, pp. 352-365*).—A critical review.

Infectiousness of milk, C. H. ERNST (*Boston, 1895; abs. in Centbl. Bakt. und Par. Med., 17 (1895), No. 18 and 19, pp. 650, 651*).

Manufacture of a new or improved milk product, J. WEITER (*Jour. Soc. Chim. Ind., 14 (1895), No. 5, p. 500*).—A patented process for preparing the dried froth of thick, fresh cream. The product looks something like butter, but smells and tastes more like milk and contains all of the valuable constituents of cream.

Gerber's acid test for milk (*Deut. landw. Presse, 22 (1895), No. 47, pp. 440, 441, fig. 1*).—The apparatus is described.

On the causes of the coloration and coagulation of milk by heat, P. CAZENEUVE and HADDON (*Compt. Rend., 120 (1895), No. 23, pp. 1272, 1273*).

Concerning the present results of investigations of sterilized milk tests, NIEMANN (*Hyg. Rundschau, 1894, p. 1012; abs. in Centbl. Bakt. und Par. Med., 17 (1895), No. 18 and 19, pp. 649, 650*).

Observations on the examination of milk and the determination of fat and albumen in fresh and condensed milk, VAN HAMEL ROOS (*Rev. Internat. Falsif., 8 (1895), No. 10, pp. 173, 174*).

Nahm's method for the estimation of fat in milk (*Milch Ztg., 24 (1895), No. 14, pp. 220–222*).—A simplification of the method previously reported in the same journal both as to apparatus and manipulation.

Melotte's No. 3 centrifuge (*Deut. landw. Presse, 22 (1895), No. 44, pp. 410, 411, fig. 1*).—The machine is described and the results of a test are tabulated.

The use of the Mohr-Westphal balance in milk analysis (*Milch Ztg., 24 (1895), No. 19, p. 303*).—See E. S. R., 6, p. 869.

Experiments with Killing's measure of viscosity (*Milch Ztg., 24 (1895), No. 12, p. 185*).

A possible error in Gerber's acid butyrometry, H. HÖFT-NORTRUP (*Milch Ztg., 24 (1895), No. 11, pp. 169, 170*).

Report of dairy department, A. H. WOOD (*New Hampshire Sta. Rpt. 1893, pp. 154–159*).—A reprint from Bulletin 20 of the station (E. S. R., 7, p. 150).

List of dairy factories in New Zealand (*New Zealand Dept. Agr., List of Dairy Factories Reported to the Department Dec. 1, 1893, pp. 4*).

Cheese and butter factories and creameries, J. SOWERS (*New Zealand Dept. Agr., Cheese and Butter Factories and Creameries: Their Construction, Equipment, and Management, 1891, pp. 32*).

The largest creamery in the world, C. W. SCHARFF (*Rural New Yorker, 1895, June 29, pp. 437, 438, figs. 4*).—A description of a coöperative creamery at St. Albans, Vermont, having a daily output of 12,000 to 20,000 lbs. of butter.

TECHNOLOGY.

Some notes on maple sirup and sugar, A. H. WOOD and F. W. MORSE (*New Hampshire Sta. Bul. 25, pp. 10–13*).—The results of analyses of 26 samples of maple sirup and 19 of maple sugar are tabulated.

"Experiments in letting sap stand for several days before boiling, filtering sap, and rapid and slow evaporation had no decisive effect on the composition of the sirup.

"The sirups from soft maples were somewhat inferior to those from rock maples both in color and flavor.

"Delay in boiling sap did not seem to affect the color of the sirup but injured its flavor. Sap that was kept 5 days and then boiled gave one of the lightest colored samples produced.

"The rapidity of boiling had little influence on the color, samples of sirup from saps that we allowed to slowly simmer away being as light colored as those from similar saps boiled rapidly.

"The lightest colored samples were produced by boiling a quantity of sap until finished, without addition of fresh sap. One sample produced by boiling about 2 qts. of sap in a large glass beaker until it was thick sirup, without addition of sap and without skimming, had little more color than the sap from which it had been made. This sap was from covered buckets and was thoroughly strained through cloth before boiling.

"Sap filtered through quartz sand produced a sirup in no way superior to the preceding, while one filtered through boneblack lost almost entirely the characteristic maple flavor.

"Sap mixed with rain water gave a sirup objectionably dark colored. . . .

"Dark sugars contained less saccharose and more reducing sugars than light sugars and had a much lower purity coëfficient."

Distilling the essential oil of limes (*Bul. Jamaica Bot. Gardens, 2 (1895), No. 5, pp. 97, 98*).

Notes on variations in determinations of oil in linseed cake, J. M. C. PATTON (*Jour. Soc. Chem. Ind., 14 (1895), No. 5, pp. 446–448*).

A new wool fat preparation and its use in sugar manufacture, G. GÖTTING (*Deut. Zuckerind., 20 (1895), No. 23, p. 832*).

On the production of wine and the manurial requirements of the vine in the Department of Pyrénées-Orientales, A. MÜNTZ and E. ROUSSEAUX (*Bul. Min. Agr. France, 14 (1895), No. 3, pp. 271–285*).—The composition of the soil and the fertilizing ingredients removed in vine growing are discussed.

Notes on progress in tanning and tanning materials, H. VON SCHROEDER (*Chem. Ztg., 19 (1895), No. 29, p. 649*).

AGRICULTURAL ENGINEERING.

Preliminary report on the seepage waters and the underflow of rivers, S. FORTIER (*Utah Sta. Bul. 38, pp. 35, figs. 6*).

Synopsis.—Observations on the amount of surface water entering, diverted for irrigation, in, and flowing out of, Ogden and Weber valleys in Weber and Morgan counties, Utah, indicate that water diverted from streams in the upper parts of these valleys returns by seepage to the lower parts without loss. Other observations indicate that the underflow fluctuated with the temperature.

This bulletin includes a discussion of the laws and conditions governing the movement of seepage or subsurface water and of the extent to which the irrigation of the upland soils has affected the moisture content of the valley soils; and records in tables and diagrams the results of the author's observations on the amount of surface water entering, diverted for irrigation, in, and flowing out of, the Ogden and Weber valleys in Weber and Morgan counties.

The results obtained in Ogden Valley, while still incomplete, seem to warrant the following conclusions:

"(1) It is clearly shown that the diversion and use of water in the district of Liberty increases the available supply to the Eden district and possibly to the districts beyond the canyon during the greater part of the irrigating period. We have here a case of third-right owners taking all the supply away from second-right owners, and by this act conferring a favor upon the latter. In like manner both third and second right owners divert the waters legally belonging to prior-right owners without injury to the latter. . . .

"(2) The diversion of immense quantities of water in the early part of the season when water is abundant, and its application to the sandy and gravelly farms of this valley, store large volumes beneath the surface which are gradually drawn off by gravity to feed the river in the dry months. The great difference between outflow and inflow can be accounted for only in this way. . . .

"(3) [Disputes regarding water rights can be equitably adjusted only by a] series of accurate measurements. . . .

"(4) If the ditches in Ogden Valley were all closed during August and September of each year, it is questionable whether the discharge of Ogden River would be much increased. . . .

"(5) A large percentage of the volume which belongs by right to the lower irrigators is now wasted in Ogden Valley in its slow passage from east to west over, or beneath the surface of, deep porous beds. The loss from evaporation in this distance, although unknown in amount, must be great. . . .

"The work of the past summer in Morgan County extended over too limited a period on which to base conclusions. If the people will only carry on the surveys

and observations which the author has begun a just settlement can be easily and cheaply obtained. The facts herein recorded show that large volumes of water can be used in Morgan Valley and still permit an outflow equal to the inflow."

The bulletin concludes with a record of observations on the fluctuation of the water level in a number of wells in Morgan County from August 2 to September 7, 1894; discussions of the beneficial effects of forests in increasing seepage flow, some injurious effects of seepage waters, and the underflow of creeks and rivers; and an account of observations on the effects of subsurface temperature upon underflow through a conduit built to tap the underflow of a creek which runs dry in periods of drought. In regard to the last subject the author states that—

"It is no exaggeration to say that many millions of dollars have been invested in both America and Europe in subsurface water supplies for cities, towns, and irrigation works, and, in so far as the writer is aware, the influence which the temperature exerts on the flow has never been brought to the attention of the public. Hydraulic engineers have assumed that the fluctuations in the discharge from underground galleries depended upon the rainfall, or upon the degree of saturation of the sand or gravel in the immediate vicinity. This assumption is, in a large measure, true for gravel or other coarse material, but does not hold true for sand, or the finer materials.

"[The observations of the author indicate] that the rainfall had no direct influence on the flow. . . .

"The case is quite different in regard to temperature. There is evidently a close relation between temperature and the underflow through fine sand. When one considers all the possible conditions which might exert an influence on the discharge in this particular case, it is, we think, surprising how closely the line of temperature corresponds to the monthly discharges."

Report on the use of metal railroad ties and on preservative processes and metal tie-plates for wooden ties, E. E. R. TRATMAN (*U. S. Dept. Agr., Division of Forestry Bul. 9, pp. 363, pls. 5*).—The use of metal ties on railways in foreign countries and in the United States, the use of metal tie-plates, preservative processes for wooden ties, and a general review of the metal track question are important divisions of the subject treated.

Windmill notes, O. P. HOOD (*The Industrialist, 20 (1895), No. 39, pp. 157, 158*).—Records observations on the power exerted by different sized mills under different wind velocities.

Agricultural machinery, RINGLEMANN (*Jour. Agr. Prat., 59 (1895), No. 25, pp. 890-894, figs. 6*).—The draft of several harrows was determined. Other agricultural implements and fixtures are described.

STATISTICS.

Report of the Statistician for May, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 126, n. ser., pp. 169-230*).—The topics of this report are the condition of winter grain and of cotton; statistics of the cotton crop of 1894; spring plowing, spring pastures, and meadows; changes in crop area; prices of wheat in England; report of European agent; notes on foreign agriculture; and transportation rates.

The world's markets for American products—Great Britain and Ireland (*U. S. Dept. Agr., Section of Foreign Markets Bul. 1, pp. 93*).—This bulletin deals with the commerce of the United Kingdom with special reference to the products imported

from the United States. Among the subjects treated are area and population, wealth and debt, statistics of agriculture and commerce of Great Britain and Ireland, and imports of cereals, butter, margarin, cheese, poultry, eggs, fruit, live stock, beef, mutton, pork and other hog products, hay, tallow, clover and other seeds, cotton and wool, agricultural implements, tobacco, wine, canned goods, wood and timber, and petroleum oil and spirit. Eight consular reports furnish facts and suggestions relative to possible markets for American products in different parts of Great Britain and Ireland.

Reports of director, treasurer, and executive committee of Colorado Station (*Colorado Sta. Rpt. 1894, pp. 1-41, pls. 2*).—List of work in progress in the different departments of the station, list of station publications, brief outline of the work at the substations, and the treasurer's report for the fiscal year ending June 30, 1894.

Annual Report of Maryland Station for 1894 (*Maryland Sta. Rpt. 1894, pp. 178-194*).—Brief general remarks on the work of the year by the director and heads of departments and a financial statement for the fiscal year ending June 30, 1894.

Annual Report of Massachusetts Hatch Station for 1893 (*Massachusetts Hatch Sta. Rpt. 1893, pp. 15*).—Brief accounts of the work of the year, with reports of some hitherto unpublished work, noticed elsewhere, and a financial statement for the fiscal year ending June 30, 1893.

Annual Report of Montana Station for 1894 (*Montana Sta. Bul. 5, pp. 129-146*).—Brief reports on the organization and work of the station, and the treasurer's report for the fiscal year ending June 30, 1894.

Reports of director and of treasurer of New Hampshire Station for 1893 (*New Hampshire Sta. Rpt. 1893, pp. 5-86, 193, 191*).—Brief report by the director and the treasurer's report for the fiscal year ending June 30, 1893.

Annual Report of North Carolina Station for 1893 (*North Carolina Sta. Rpt. 1893, pp. 50*) —This includes reports on the fertilizer control; brief reports on the work and publications of the station, including a list of the bulletins published; short general reports by the agriculturist, assistant chemist, botanist and entomologist, horticulturist, and meteorologist; and a financial statement for the year ending June 30, 1893.

The agricultural experiment station of Halle, E. SAILLARD (*Ann. Sci. Agron., 6 (1893), II, No. 2, pp. 167-201*).

The schools of grafting in Haute-Savoie (France), H. BOIRET (*Jour. Agr. Prat., 59 (1895), No. 22, pp. 781, 782*).—A brief account of the instruction given in a short course in grafting.

The Chino Valley Experiment Station, C. H. SHINN (*Garden and Forest, 8 (1895), No. 379, pp. 212, 213*).—A popular description of this station and its work.

Notes on agriculture, III, B. D. HALSTED (*Science, n. ser., 1 (1895), No. 25, pp. 680-682*).—Notices are given of the Experiment Station Record and Bailey's Horticulturists' Rule Book.

NOTES.

ARIZONA STATION.—At a recent meeting of the regents of the University, W. S. Devol was made director.

CONNECTICUT STORRS STATION.—By an act of the general assembly of Connecticut of June 25, 1895, $1,800 is appropriated annually "for the purpose of investigating the economy of the food and nutrition of man, and for investigations of the bacteria of milk, butter, and cheese, and their effect in the dairy."

MASSACHUSETTS STATION.—The permanent organization of the Hatch Experiment Station of the Massachusetts Agricultural College is as follows: H. H. Goodell, director; C. A. Goessmann, honorary director and chemist; W. P. Brooks, agriculturist; S. T. Maynard, horticulturist; C. H. Fernald, entomologist; J. B. Lindsey, associate chemist—feeding experiments; G. E. Stone, botanist and mycologist; G. F. Mills, treasurer; C. S. Crocker, H. D. Haskins, C. H. Johnson, and E. B. Holland, assistant chemists; Henry M. Thomson, assistant agriculturist; Ralph E. Smith, assistant botanist and mycologist; Robert A. Cooley, assistant entomologist.

OHIO STATION.—This station has begun the erection of a fireproof chemical laboratory, designed as a wing to the main building, to be built hereafter. The laboratory will be 36 by 70 ft. in size, 1½ stories high, with basement for storage. The contract price is $13,767.

WYOMING STATION.—The board of trustees, at their recent session, determined to make the Lander Experiment Farm a substation for scientific research in animal industry and agriculture. Mr. J. S. Meyer remains as superintendent until December 31, and Prof. H. S. Kendall goes to Lander as assistant superintendent, having charge of the scientific part of the work in animal industry and agriculture.

PERSONAL MENTION.—Mr. W. Carruthers has been retired from the position of curator of the Kew Botanical Museum under the age limit, and will be succeeded by Mr. G. Murray.

Prof. Dr. E. Borgmann died at Wiesbaden April 5, 1895.

EXPERIMENT STATION RECORD.

VOL. VII. No. 3.

For the first time in its history the Association of American Agricultural Colleges and Experiment Stations this year held its annual convention west of the Mississippi River. The executive committee selected Denver with some misgivings lest the long journeys thus imposed upon most of the delegates should so materially reduce the attendance as to seriously diminish the value of the convention. The result, however, fully justified the choice of this city as the place of meeting. As indicated in our report of the convention on succeeding pages, the attendance was fully up to the average and every section of the country was well represented. The general arrangements for the convention were excellent and facilitated the transaction of business. All the sessions were well attended and the discussions were earnest, and, as a rule, on topics of much importance. In the sections an unusual number of carefully prepared papers was read and quite thoroughly discussed. Even in the informal conferences, held in the intervals between regular sessions, college and station topics were uppermost. It was preëminently a business convention.

One of the most valuable discussions of the convention was that relating to the methods of teaching agriculture. The leading paper, by Professor Hunt, of Ohio, was a remarkably clear presentation of some of the principles which must underlie the formulating of any good method of instruction in agriculture and was illustrated by references to the author's own work in this line, which showed that his theories had a substantial support in intelligent and successful practice. The interest of the Association in this vital matter was afterwards shown by the appointment of a standing committee to inquire into the methods of teaching agriculture in different countries, with a view to making suggestions for improvements in the methods now employed in this country.

A gratifying feature of this convention was the more thorough character of the reports of the chairmen of sections on the progress of experiment station work in their respective lines. These annual résumés, when carefully prepared, serve to bring out the importance of the work which our stations are doing in various branches of agricultural science, and indicate ways in which deficiencies and weaknesses in station work may be corrected.

Very naturally questions relating to irrigation were much discussed at this convention, both formally and informally. One entire session of the section on agriculture and chemistry was devoted to this subject. The Western delegates, being profoundly convinced of the importance of irrigation in that part of the country, and knowing something of the serious problems still remaining unsolved, were most interested in matters relating to the improvement in methods of irrigation and in reports of investigations the results of which might indicate ways of removing the difficulties now encountered in the practical application of irrigation to agriculture. The Eastern delegates, on the other hand, were delighted to see the systems of irrigation in practical use on a large scale as exhibited in the vicinity of the agricultural college at Fort Collins and at other points to which excursions were made. They listened with great interest to explanations of the methods of irrigation, and were filled with astonishment at the marvelous results which they saw being worked out in regions which a few years ago were classed as desert lands.

Recent droughts in the East have so clearly shown the need of some means of supplying the lack of water in that section in certain seasons that there is a growing demand that the stations shall aid in devising economical methods for storing and using whatever water may be available for this purpose. It was not, therefore, mere curiosity which led the representatives of Eastern stations to take so much interest in irrigation as practiced in the vicinity of Denver.

Certain unfavorable features in the present methods of irrigation were brought out in the papers and discussions in the convention, notably by Professor Hilgard, of California, in his talk regarding the rise of alkali in the soil. It is evident that serious dangers confront the farmers who are using irrigation in many parts of the West, and many problems will have to be solved before permanent prosperity from the use of irrigation waters can be assured. The importance of this matter fully justifies the experiment stations in the West in undertaking the investigations of these questions in a thorough way. Thus far a number of these stations have devoted themselves principally to determining what kinds of crops can be best grown under irrigation. This matter is now, however, so well understood in most localities that the stations can safely leave this line of work to enterprising farmers and devote themselves to the more difficult problems which require the aid of science for solution.

NINTH ANNUAL CONVENTION OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

The ninth annual convention of the Association of American Agricultural Colleges and Experiment Stations was held at the Brown Palace Hotel, Denver, Colorado, July 16–19, 1895. There were present over 100 delegates and visitors, representing 39 States and Territories, the Department of Agriculture, and the Dominion of Canada. The States not represented were Connecticut, Idaho, Indiana, Maine, North Carolina, South Carolina, South Dakota, Tennessee, and Virginia.

The convention was called to order by President H. E. Alvord. After prayer by President Stubbs, of the Nevada University, addresses of welcome were delivered by Governor McIntyre, of Colorado, and Mayor McMurray, of Denver, to which President Alvord replied.

The report of the executive committee, submitted by the chairman, H. H. Goodell, of Massachusetts, noted the failure of the committee to secure the printing by the Government of the data secured in the Columbian Dairy Test; and stated that it had been deemed unwise to ask legislation appropriating money for furnishing uniforms and other equipment to the colleges and detailing an Army officer to each college for military instruction. The report also showed that in 1893 there were issued from 35 stations 249 bulletins and reports containing 75,537,270 pages. There were handled at the post-offices from which they were mailed 1,741,495 separate pieces weighing 276,495 pounds. The executive committee was instructed to continue investigation in this line with a view to memorializing the Postmaster-General to allow postmasters handling this mail extra pay.

From the section on agriculture and chemistry Chairman E. B. Voorhees, of New Jersey, presented a carefully prepared report, based on data obtained from the several institutions, which showed that useful work in agriculture and chemistry was in progress at the stations in the following lines: (1) The comparative advantages of rotative cropping; (2) the adaptation of cereals, grasses, and forage plants; (3) the chemical composition of useful plants in their different stages of growth; (4) the chemical study of manures (natural and artificial), with experiments to test the effects on crops of different kinds; (5) the analysis of soils and waters; (6) the composition and digestibility of food for domestic animals; (7) the economic questions involved in the production of dairy products; and (8) other researches bearing directly upon

the agricultural industry of the United States, including (*a*) variety tests and methods of seeding and culture of farm crops; (*b*) animal nutrition; (*c*) the development of natural resources and improvement of industrial interests; (*d*) irrigation, drainage, and soil improvement; and (*e*) miscellaneous studies and experiments (local problems and methods of work).

The report of the section on entomology, submitted by C. P. Gillette, of Colorado, reviewed the growth of entomological investigation and instruction since the establishment of the land-grant colleges; called attention to the best collections of the different orders of insects and where they may be found; and gave lists of the insects causing the heaviest losses in different localities and the number of reports on each. The amount of literature and the more important investigations of the past year were also noted. It is stated that during the last school year nearly 800 students received instruction in entomology in the land-grant colleges. The investigations on chinch-bug diseases by S. A. Forbes, the invention of an apparatus for applying kerosene with water directly by H. E. Weed, and the use of arsenate of lead as an insecticide by T. C. Moulton, were referred to as probably the most important advances in economic entomology during the year.

The report of the section on botany and horticulture, prepared by S. M. Tracy, of Mississippi, but presented by W. R. Lazenby, of Ohio discussed the work of the year in the botanical and horticultura departments of the different stations. Eighty men, representing 50 stations, are engaged in these lines, work on fruits at present receiving most attention.

"Irrigation, both surface and subearth, is yearly claiming more attention; and, strangely, we find that fully as much work is being expended in that direction in the East as in the West, which may be partially from the fact that it is a new line of inquiry in the Eastern States."

A brief report from the section on mechanic arts was presented by F. P. Anderson, of Kentucky, advocating the correlation of the mechanic arts and agriculture.

The report of the section on college work, submitted by J. H. Connell, of Texas, was a review of the work being done in the agricultural colleges of the country.

The annual address, delivered by President H. E. Alvord, briefly reviewed the history of the Association and discussed its importance as an aid to the agricultural colleges and experiment stations. To raise the standard of work and promote the public good was stated to be the mission of the Association, and it was claimed that its influence in these directions had been great and beneficial. He urged that there should be greater coöperation among the stations in the publication of results useful in different localities. The necessity of greater strictness in the administration of public funds on the part of a few institutions was clearly brought out. The thorough enforcement of the provisions

of the law giving the Secretary of Agriculture authority to scrutinize the expenditures of the stations was demanded in behalf of the Association. The desirability of criticism of the work of the stations by the Department was also advocated. He called attention to the low grade of work being done at some of the colleges connected with the Association, and pointed out that the acts of Congress under which these institutions are organized did not contemplate preparatory or high school courses.

A committee consisting of H. C. White, of Georgia; C. O. Flagg, of Rhode Island; E. A. Bryan, of Washington; H. P. Armsby, of Pennsylvania, and P. Schweitzer, of Missouri, to which the recommendations and suggestions contained in the address of President Alvord were referred, reported as follows:

Resolved, First, that a special committee of three, of which the retiring president shall be chairman, be appointed to codify the resolutions and declarations of previous meetings of the Association concerning uniformity in action on the part of the colleges or stations in matters of common interest, said committee to report at the next annual convention of the Association.

Second, that the executive committee be requested to prepare a circular letter embodying such extracts from the president's address as may be proper to set forth succinctly the objects and utility of this Association, and to forward the same to such colleges and stations as may not now be members of this Association, with a view to secure active membership in the Association of every college and station eligible thereto.

Third, that the executive committee be requested to consider the advisability of assigning a place on the program for the next annual convention to the discussion of the matters of station bulletins and the participation of the stations and colleges in farmers' institutes, agricultural exhibitions, etc.

Fourth, that the executive committee be instructed to continue the effort to secure the establishment of an office of land-grant colleges in the Bureau of Education, Department of the Interior, on the line recommended by this Association at the eighth annual convention, approved by the honorable Secretary of the Interior, it being the opinion of this Association that the provision made for this purpose by the last Congress is inadequate for such an office as was contemplated in the recommendation of this Association to the Secretary of the Interior.

Fifth, that this Association cordially approves of and indorses the sentiments expressed by the president in his address, as follows: "It is certain that Congress never intended by land grants or annuities to relieve any State or Territory from the duty of providing its own high schools and grammar schools. . . . The legality of applying the so-called 'Morrill funds' to the support of preparatory departments is to be doubted in any case. In a few exceptional instances the circumstances may justify a land-grant college in making temporary provision for preparing students for its college classes. But the expense of such work should certainly be met from other funds as soon as possible, and the responsibility of public school service of all grades thrown upon local authorities. The institutions in affiliation with this Association should in all respects be colleges in fact as well as in name."

Sixth, that this Association emphasizes the importance of so administering and accounting for the "Hatch fund" as to preclude any charge that it is being diverted from its sole legitimate object, viz, agricultural experimentation and research and the dissemination of the results thereof, and to that end heartily indorses and reaffirms such portions of the report of the committee of this Association of date October 19, 1887, as refer to this subject.

Seventh, that it is the opinion of this Association that the efficiency and success of station work will be most effectually secured and the business affairs of the stations most efficiently conducted by the organization of each station with a single executive head responsible to the governing board of the institution and representing the station in its relations to the public and to the Department of Agriculture.

After an earnest discussion resolutions five and seven were laid over one year for action and the others were adopted.

"Methods of instruction in teaching agriculture" was presented in general session from the section on college work, and discussed by T. F. Hunt, of Ohio, and others. Professor Hunt stated that while he was unalterably committed to technical instruction in agriculture, he would prefer a man well educated in Greek to conduct a farm for him to one poorly educated in agriculture. He believed that the previous training of most students had prepared them to *do* much more proficiently than to *think*. Special attention should therefore be given to their mental training. He gave in some detail his methods of instruction and stated that there was at present no well formulated system which could be followed. He advocated an attempt to formulate a schedule to be followed by all the colleges. Until this was done the science of agriculture could scarcely rank with other sciences.

W. M. Hays, of Minnesota, gave an outline of courses in agriculture in the University of Minnesota. He advocated the laboratory system of instruction in the higher college work and the establishment of high-school courses in order to reach the masses.

W. W. Cooke, of Colorado, discussed particularly the 4-year college course and opposed manual training in agriculture except for illustrative purposes.

A. C. True, of this Office, thought that the professor of agriculture should give more attention to methods of teaching. It was of primary importance that he should carefully consider the selection and order of topics to be taught and the way in which they should be imparted to the student. He stated his belief that by pursuing this method the earnest teacher would be able to develop a course in agriculture along the right lines, as had been done in other subjects.

The second subject presented by the section on college work, "What studies should be embraced in the 4-year B. S. course?" was taken up by A. Ellis, of Colorado, who compared the course of 30 years ago with that of the present time. He thought the tendency to-day was to specialize too soon, and he advocated giving a well-rounded course before taking up a technical course.

F. P. Anderson, of Kentucky, spoke of the multiplication of degrees in American colleges and of the difficulties which were to be met in attempting to get in a 4-year course all the studies necessary for a well rounded education and at the same time enough of the scientific studies to make it worthy of the designation of a technical course.

E. W. Hilgard, of California, stated that the aim should be to give a high education. Colleges were organized to teach the sciences.

They are not expected to teach the rank and file of the farmers, but to educate the leaders, the teachers, and investigators. It is more credit to educate a few well than a large number poorly.

J. H. Connell, of Texas; T. F. Hunt, of Ohio; A. C. True, of this Office; H. T. French, of Oregon, and L. B. Wing, of Ohio, were appointed a standing committee whose duty it shall be to report annually upon the best methods used in the various colleges of the world for the instruction of students in the practical and scientific facts relating to agriculture with a view to reducing instruction in agriculture to pedagogic form.

C. S. Murkland, of New Hampshire, reporting from the committee on entrance requirements for college courses, appointed at the last convention, said that it was deemed advisable to wait until a similar committee of the Society for the Promotion of Engineering Education had finished their investigations and made a report before taking action on the matter. The report was accepted and the committee continued.

A paper on "How shall we teach horticulture?" was read by W. R. Lazenby, of Ohio. He urged that while horticulture should be taught as an art instruction in correlated branches should be included in horticultural courses. More attention should be given to floriculture.

E. S. Goff, of Wisconsin, discussed two classes of students: (1) Those who have had scientific training—with this class horticultural instruction is an easy matter; (2) those having only a common-school education, no training in sciences, and undeveloped powers of observation. It is difficult to interest this class. It should be assumed that they have no knowledge of science and they should be interested through their hands rather than through their ears. Illustrative experiments should be conducted by the student and he should then be questioned to bring out the whys and wherefores.

"Uniformity in nomenclature in station publications" was discussed by H. P. Armsby, of Pennsylvania, who spoke of the want of uniformity and the resulting confusion, and moved that a committee be appointed to take the question into consideration and report at the next meeting. The following committee was appointed: H. P. Armsby, of Pennsylvania; E. H. Jenkins, of Connecticut; S. M. Tracy, of Mississippi: T. F. Hunt, of Ohio, and C. P. Gillette, of Colorado.

"The distribution of salts in alkali soils" was the subject of a paper by E. W. Hilgard, of California. He stated that the rise of alkali, brought about by irrigation, was not necessarily due to the saline character of irrigation water used, but to the fact that the alkali salts are simply brought up by evaporation from the soil itself. Rainfall in regions where alkali occurs rarely wets the soil to a greater depth than 3 ft., hence there is an accumulation of alkali at this depth. When, however, irrigation water is applied to the soil an upward movement

of soil water sets in and the soluble salts rise to the surface. The bulk of alkali salts even in natural alkali lands is therefore accumulated within easy reach of the surface and of underdrains, and if this accumulation is once removed there is little danger that sufficient alkali to do any harm will ever again come from below. Charts were exhibited which showed that the proportion of carbonate of soda (black alkali) decreased as the surface was approached and confirmed the conclusion "that whenever an alkali soil is subjected to the action of stagnant water or of abundant moisture without aëration the formation of black alkali will take place."

A paper on "Development and modifications of the mouth part of insects," illustrated by stereopticon views, was read by J. B. Smith, of New Jersey.

A paper on "The theoretical *vs.* practical work of an engineering course" was presented by L. C. Colburn, of Wyoming.

F. W. Rane, of West Virginia, read a paper on "Some undefined duties of station horticulturists."

A paper on "The bacterial flora of fore-milk" was read by H. L. Bolley, of North Dakota.

A. C. True gave a brief account of the work of the Office of Experiment Stations during the past year, as preliminary to the reading of a paper on "Permanent elements in experiment station work." He stated that Americans have hardly yet grasped the idea of permanency in educational and scientific institutions. Changes in the governing boards, and in the working forces of colleges and experiment stations are far too frequent to secure the best results in education or experimental inquiry. The tenure of office in these institutions should be sufficiently long to encourage the planning of thorough investigations and insure their management under a consistent policy until valuable results could reasonably be expected. The introduction of political or other disturbing influences should be carefully guarded against. A system of annual elections of college and station officers is both foolish and cruel. The permanency and value of station work would be enhanced by giving the station such an organization as would make it stand out clearly as a distinct department of the college. Permanent records of experiments should be kept on a thorough plan as the property of the station. It is an important function of the experiment station to accumulate data which may serve as a mine of information to future investigators. Every station should expect to gather many facts which it did not intend to publish. Some experiments should be undertaken which must necessarily run through a long series of years before useful practical results could be expected. The stations have done enough already to clearly demonstrate the value of their services to farmers. They may now be considered as permanent agents for

improving agriculture. Their organization and work should therefore be of a character befitting institutions established for all time.

The same committee, to which the president's address was referred, after consideration of the paper of Director True, reported the following, which was adopted:

That the association heartily indorses the suggestions contained in the address of Director True upon "Permanent elements in experiment station work," and that in particular it regards reasonable permanence in tenure of office of the governing body and the station officers, and the preparation and careful preservation of full, systematic, and accurate records as essential elements of successful station work.

A call of the roll of States developed the fact that at least 18 States have no legislation providing for the control of tuberculosis, but in 20 this is provided for either by special legislation or in the general laws relating to contagious diseases, boards of health, etc.

A petition signed by 11 members of the Association for the organization of a permanent section on agricultural engineering and irrigation was presented to the convention and referred to the executive committee. This committee reported unfavorably on the proposition, and its recommendations were adopted by the convention. One session of the section on agriculture and chemistry, however, was devoted solely to the consideration of irrigation subjects.

A committee consisting of the chairman of the executive committee, W. M. Hays, of Minnesota, and the secretary of the Association, was appointed "to confer with the Department of Agriculture with reference to the preparation and publication of a catalogue of literature for the use of teachers and students of agriculture, with power to arrange for the publication of such catalogue if this is found to be practicable."

A committee of three, H. H. Goodell, A. C. True, and H. E. Alvord, was appointed to codify important acts of the Association in previous years.

The following amendment to the constitution was offered by H. P. Armsby, to be acted upon at the next meeting of the Association:

No delegate shall vote in more than one section, and each delegate shall, when presenting his credentials, designate the section in which he intends to vote.

The consideration of the amendment to the constitution changing the name of the Association, proposed at the last convention by R. W. Silvester, of Maryland, was laid over.

A resolution recommending the adoption of the metric system as the legal standard of weights and measures, introduced by H. J. Wheeler, of Rhode Island, was laid on the table.

The convention ratified a resolution reported from the section on agriculture and chemistry providing for the reporting of the results of dairy tests in terms of butter fat, using the factor $1\frac{1}{6}$ for converting into butter (see report of the section, p. 177).

Resolutions on the death of Drs. N. S. Townsend and E. D. Porter were adopted by the convention.

The invitation to hold the next convention of the Association at the University of Minnesota was referred to the incoming executive committee.

By the courtesy of the Chamber of Commerce of Denver the Association enjoyed a car ride through the principal streets of the city. There was also an excursion to Fort Collins, where the Association was very hospitably entertained and afforded every opportunity to examine the buildings and work of the agricultural institutions located there.

The officers of the Association for the ensuing year are as follows:

President, S. W. Johnson, of Connecticut; vice-presidents, C. Northrup of Minnesota, J. H. Connell of Texas, S. W. Robinson of Ohio, E. A. Bryan of Washington, R. H. Jesse of Missouri; secretary and treasurer, J. H. Washburn, of Rhode Island; executive committee, the president, secretary and treasurer, and junior ex-president (H. E. Alvord), H. H. Goodell of Massachusetts, A. Ellis of Colorado, H. C. White of Georgia, and E. B. Voorhees of New Jersey; bibliographer, A. C. True, of Washington, D. C.

Section on agriculture and chemistry.—Chairman, C. C. Georgeson, of Kansas; vice-chairman, C. F. Curtiss, of Iowa; secretary, H. J. Patterson, of Maryland.

Section on college work.—Chairman, A. A. Johnson, of Wyoming; vice-chairman, J. E. Stubbs, of Nevada; secretary, E. Davenport, of Illinois.

Section on entomology.—Chairman, O. Lugger, of Minnesota; secretary, G. C. Davis, of Michigan.

Section on horticulture and botany.—Chairman, F W. Card, of Nebraska; secretary, H. L. Bolley, of North Dakota.

Section on mechanic arts.—Chairman, J. W. Lawrence, of Colorado; vice-chairman, S. Fortier, of Utah; secretary, F. P. Anderson, of Kentucky.

MEETINGS OF THE SECTIONS.

In the section on college work C. C. Georgeson, of Kansas, briefly discussed agricultural education in Denmark. The agricultural courses in Denmark differ materially from those offered by our schools and colleges. They are practical but strictly technical, embracing no subject which does not relate directly to agriculture.

E. W. Hilgard, of California, spoke of agricultural instruction in Prussia, stating that training in this line is of a very high character and that the students are in demand for superintendents of large estates.

In the section on agriculture and chemistry, E. B. Voorhees, of New Jersey, presiding, W. C. Latta, of Indiana, opened the discussion on "Methods of plat experimentation," devoting his attention especially to the size and arrangement of plats for field experiments. He advocated long, narrow tenth-acre plats with intervening spaces one-half the width of the plats. These plats should be arranged in series and the treatment duplicated or triplicated if possible. Plowing and harvesting across plats, but harrowing lengthwise and counting vacancies and calculating the yield as though the stand were perfect were advocated.

C. C. Georgeson, of Kansas, preferred one-twentieth acre plats of a long narrow form with 2-foot spaces between.

R. J. Redding, of Georgia, preferred a large number of small plats, say about 400 sq. ft., with boards bounding the sides of the plats so as to preserve the exact margins.

E. W. Hilgard, of California, criticised plat experiments on account of the insufficiency of data regarding the character of the soil. He insisted that soils should be more definitely defined, and that a limited number of points should be investigated at one time.

A discussion on the subject, "Shall the results secured in dairy tests be stated as butter fat or its equivalent in butter? The adoption of a conversion factor" was opened by H. P. Armsby, of Pennsylvania, and participated in by W. W. Cooke, of Colorado; C. F. Curtiss, of Iowa; C. D. Smith, of Michigan; T. L. Haecker, of Minnesota; H. E. Alvord, of this Department; and M. A. Scovell, of Kentucky. The matter was finally referred to a committee of three, consisting of C. F. Curtiss, H. P. Armsby, and W. W. Cooke, which reported as follows:

Resolved, That this Association recommends to the several stations that the results of tests of dairy cows or herds be expressed in terms of butter fat, and that when desirable to express these records in terms of approximate equivalent in butter that such equivalent be computed by multiplying the amount of butter fat by $1\frac{1}{6}$

The factor $1\frac{1}{6}$ is based upon the results of the Columbian Dairy Test, in which it was found that on an average 117.3 lbs. of butter was made from each 100 lbs. of butter fat in the whole milk.

In discussing the subject, "A practicum in stock feeding," H. P. Armsby, of Pennsylvania, stated that one of the difficult problems that confront the teacher in agriculture is to provide practical or laboratory work. The method that he adopted with his classes during the past winter was as follows: The class was divided into 3 sections and a certain number of cows assigned to each section. General instruction by lectures upon comparative value of the feeding stuffs on hand and the prices of the same, together with the previous records of the respective cows, were given to each section. The class was then required to feed the cows and keep a record of the products. The system apparently worked well and served to fix the subject in the minds of the students.

A paper on "Practical methods of maintaining fertility" was read by J. H. Connell, of Texas, which discussed the economy of using leguminous crops as green manures and supplementing them with commercial fertilizers. The necessity for calling attention to the wastes on the farm and explaining methods of conserving its manurial resources was particularly dwelt on.

"Individuality as a prime factor in experiment station feeding" was discussed in a paper by C. D. Smith, of Michigan, in which he clearly brought out the necessity for a careful preliminary study of the individual peculiarities of the animals under trial in order to ascertain with any degree of certainty the effects of the food. The paper was illustrated by charts showing the results of experiments conducted at the Michigan Station.

"The objects of experimenting in dairy feeding" was the subject of a discussion which was opened by W. W. Cooke, of Colorado, who stated that there was little question ten years ago that a ratio of 1:5.4 was the proper one for a dairy cow. Under present conditions of expensive albuminoids and cheap carbohydrates and fat there is tendency to widen the ratio, the latter frequently being 1:7, not because this ratio is the one best suited to the animal, but because it is commercially the cheapest. He advised experiments looking toward the establishment of a proper ration from the physiological rather than from the commercial standpoint.

A. A. Mills, of Utah, read a paper on "Length of periods in experiment station feeding," in which he called attention to the danger of error in drawing conclusions from short periods, illustrating his remarks with results obtained in feeding periods of different lengths at the Utah and other stations, all of which indicated that short periods gave very misleading results and could not be relied upon for conclusions.

On the subject of "Digestion experiments" H. P. Armsby, of Pennsylvania, exhibited charts showing the averages of digestion experiments with maintenance rations. He also showed harness apparatus for collecting urine and excreta.

On the subject of "Late progress in soil analysis" E. W. Hilgard, of California, discussed the success of soil analysis as conducted in Europe and America, and gave a critical review of progress in attempts to devise methods of determining available plant food in the soil. He reported analyses of a number of California and Hawaiian soils, using nitric acid sp. gr. 1.2, hydrochloric acid sp. gr. 1.115, and 2 per cent citric acid as solvents; and determinations of the nitrogen content of the soil humus. The results are thought to justify—

"The hope that we are on the trail of a method for the definite ascertainment of the condition of a soil as to available (non-nitric) nitrogen, which with the method of Dyer for the corresponding determinations with respect to potash and phosphoric acid, when all are perfected, would effectually solve the problem of the manure requirements of cultivated soils, that has so long resisted the efforts of chemists. There can be no doubt that differences in the other soil ingredients will influence the lower limits of each of the three primarily important substances; more especially will the presence or absence of an adequate amount of lime to keep the soil in a non-acid condition and to perform the many other important functions of that base, be doubtless found very important."

In a session of this section devoted by agreement to the subject of irrigation, L. G. Carpenter, of Colorado, gave an explanation and general outline of the irrigation systems in use in Colorado.

W. W. Cooke, of Colorado, spoke of the use of siphons made of terra-cotta piping, with cemented joints, for conveying water to higher portions of the farm than that reached by the general system of ditches.

In the section on horticulture and botany L. H. Pammel, of Iowa, read a paper on "Weed studies," in which he called attention to the

great importance of weeds to the farmers of the United States, discussing the subject from both the scientific and the practical standpoint. He advocated the display of specimens of noxious weeds, accompanied by plainly written descriptions, at various localities in infested areas, and also commended the use of large poster bulletins and newspaper notes.

Professor Pammel also read a paper on "Bacteriological methods and bacteriological work."

Under the title of "A new spraying apparatus," E. S. Goff, of Wisconsin, described an attachment for spraying pumps for keeping the spray solutions thoroughly mixed during application.

A paper on "Value of fruit tests in different localities," was presented by M. H. Beckwith, of Delaware, in which a more careful study of the adaptability of different varieties of fruits to particular localities was advocated.

F. W. Card, of Nebraska, presented a paper on "Soil moisture as influenced by local factors," in which the necessity for a liberal supply of soil moisture in order to obtain vigorous and healthy plant growth was pointed out.

A. Nelson, of Wyoming, read a paper on "The relation of systematic to the economic botanical work of the station." He advocated a liberal interpretation of the purposes of the station, believing that each station should have a special line of investigation and that its work should be utilitarian in all cases.

H. L. Bolley presented a paper on "The necessity of a fuller consideration of nonlocal conditions in botanical investigations." He maintained that station work along botanical lines had been somewhat too local. He insisted that local conditions should be studied in their general relations, and that in this respect there should be more unity and coöperation among the stations in the United States. "Let us have accurate publication and let stations republish instead of trying to reinvestigate."

In addition to the papers noted above, the following were also read before the section: "The forage problems in the West," by J. W. Toumey, of Arizona; "Methods of studying parasitic fungi," by G. F. Atkinson, of New York; "Soil treatment for fungus diseases in connection with crop rotation," by B. D. Halsted, of New Jersey; "Is variety testing of sufficient importance to justify its cost?" by S. A. Beach; and "Results reached in crossing," by J. L. Budd.

In the section on entomology a paper on "Plant lice of the chrysanthemum" was read by T. A. Williams, of South Dakota, which described two new species, one a green and the other a brown form, and suggested kerosene emulsion as a remedy for these insects. In the discussion which followed the facts were brought out that the green species was quite readily controlled by the ordinary methods employed by florists, but that the dark-colored species required a different treat-

ment. J. B. Smith, of New Jersey, reported that he had used fumes of bisulphid of carbon for this purpose with success.

T. D. A. Cockerell, of New Mexico, read a paper entitled "The entomologist's platform," in which he urged the desirability of entomologists deciding upon some definite plan to further those reforms concerning which they are all agreed. The first plank of the proposed platform related to the prevention of the spread of noxious insects, and especially scale insects. The second related to publications, and the third to instruction in entomology.

In a paper "On the study of forest-tree insects of West Virginia," the writer, A. D. Hopkins, of West Virginia, expressed the opinion that 10 per cent of the immense loss caused by these insects could be prevented by the adoption of simple practical methods of combating the pests. Among the latter he enumerated attention to the date of cutting, to barking, and other methods of handling trees cut for timber or economic purposes.

A paper by the same author was presented on "The plum-tree gall mite," describing the characteristics of the insect, the nature and extent of its injury to trees, and noting the failure of ordinary methods of treatment.

C. P. Gillette, of Colorado, read a paper on "Two leaf rollers," in which he described two species of this insect which are very prevalent and destructive in Colorado. Experiments by the author have shown that it may be destroyed either in the egg or worm state. In the first case the most successful remedies are very strong kerosene emulsion applied during the winter, or an application of ordinary whitewash just before the eggs hatch or about the time the buds of the trees begin to open. In the second case Paris green applied in water in the proportion of 1 lb. to 75 gal. of water with about 2 lbs. of lime added has been found effective. The first application of this insecticide should be made as soon as the rolling of the leaves is perceptible, and the application should be repeated once in 2 weeks as long as needed. An interesting fact noticed in connection with the destruction of this pest is that a bacterial disease has appeared at Fort Collins that has destroyed the worms in large numbers.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of nitrogen in fertilizers containing nitrates, H. C. SHERMAN (*Jour. Am. Chem. Soc., 17 (1895), No. 7, pp. 567-576*).—After a test of the various official methods for the estimation of nitrogen, the author reached the following conclusions:

"(1) For fertilizers containing little or no chlorids the official methods are perfectly reliable if the directions are followed closely and the digestion in the modified Gunning method is continued for a short time after the liquid has become practically colorless. . . .

"(2) In working with samples containing considerable amounts of chlorids it is advisable to use the modified Kjeldahl (zinc dust) method and to cool the acid mixture before adding it to the substance. It appears advisable also to digest for some time at ordinary temperature before adding zinc dust. No way has been found by which accurate results can be obtained by the modified Gunning method in the presence of large amounts of chlorids together with high percentages of nitric nitrogen.

"(3) When determining high percentages of nitric nitrogen by the modified Gunning method it is necessary either to continue the boiling for some time after the contents of the flask have become colorless, or to use permanganate to complete the action."

—J. P. STREET

The citrate method of phosphoric acid determination, with special reference to insoluble phosphates, F. BERGAMI (*Jour. Franklin Inst., 140 (1895), No. 2, pp. 139-152*).—The author used the following method: Boil 2 gm. of sample with 40 cc. concentrated nitric acid and 10 cc. hydrochloric acid; dilute to 250 cc. Mix aliquot parts corresponding to 0.2 and 0.4 gm. of substance with 25, 50, 75, and 100 cc. of citrate solution, respectively. After adding 25 cc. official magnesia mixture the complete precipitation of magnesium-ammonium phosphate is effected by vigorous stirring with a glass rod for half an hour; the precipitate is treated as usual.[1] The results showed that success depends largely on the amount of citrate solution used. In high-grade phosphates (20 to 35 per cent) 50 to 75 cc. of citrate for 0.2 gm. of substance, or 75 to 100 cc. for 0.4 gm., give the best results.

In testing this method for insoluble phosphoric acid the author obtained slightly lower results than by the molybdate method, probably due to an excess of citrate. When the magnesia mixture is added the solution must be vigorously stirred for half an hour. The filtration must

[1]The citrate was made according to Maercker's formula: 150 gm. citric acid dissolved in water, 500 cc. of 24 per cent ammonia added, and whole made up to 1,500 cc. by addition of water.

also be done with great care, owing to the finely divided state of the precipitate.

While the author's work is only preliminary in its character, his success with the method promises to make it available as a quick and practicable one for the estimation of phosphoric acid.—J. P. STREET.

On the determination of small quantities of phosphoric acid by the citrate method, E. G. RUNYAN and H. W. WILEY (*Jour. Am. Chem. Soc., 17 (1895), No. 7, pp. 513-516*).—The authors reached the following conclusions:

"(1) In all cases of samples of tricalcium phosphate, or acid phosphates made therefrom, containing the usual accompanying substances, the phosphoric acid may be correctly estimated by direct precipitation with magnesium citrate.

"(2) In all cases of the analysis of natural rock phosphates containing less than 5 per cent of phosphoric acid it is necessary to fortify the solution before precipitation by adding a measured quantity of a solution of phosphoric acid of known strength.

"(3) The fortifying solutions employed may be made either from natural tricalcium phosphates or from chemically pure phosphate salts.

"(4) The direct precipitation of the phosphoric acid in the presence of ammonium citrate by ammoniacal magnesia mixture is a quicker and less expensive process than the official molybdenum method and leads to results equally accurate."

The natural iron and aluminium phosphates were not tested.—J. P. STREET.

The chemical nature of diastase, T. B. OSBORNE (*Connecticut State Sta. Rpt. 1894, pp. 192-207; and Jour. Amer. Chem. Soc., 17 (1895), No. 8, pp. 587-603*).—In his investigations of the proteids of wheat, rye, and barley the author has found the same albumin in all of them, and was impressed with the close relation between the temperature at which this albumin coagulates and at which diastase begins to lose its activity. Since the aqueous extracts of these seeds possess considerable diastatic power it was suggested that this might be due to the albumin. The results here reported are regarded as preliminary. The method used for preparing the enzym, which differs from the one usually employed, was to—

"First separate the proteids from the carbohydrates and other soluble substances by saturating the extract with ammonium sulphate, thereby precipitating the ferment and proteids together; next to remove the proteid existing as globulin by dialysis; and then, if possible, to separate the albumin and proteoses by fractional precipitation with alcohol. In following this method a measured quantity of malt extract was saturated with ammonium sulphate, the precipitated proteid matter was filtered out, dissolved in water, and the clear filtered solution made up to the volume of the original extract. This solution was found to have the same diastatic power as before precipitation, thus showing that ammonium sulphate had not injured the diastase. Throughout my work diastatic power has been measured by Lintner's method."

Lintner's method of extracting the malt with water containing 20 per cent of alcohol was tried and found "not suited for a subsequent precipitation of the proteids with ammonium sulphate." By fractional precipitation of the aqueous extract of 10 kg. of malt 5 separate precip-

itates were obtained, which were further split up by treatment with water and saline solutions, and the preparations studied.

"In the first place, it is plain that we have in our malt extract a globulin, an albumin, and at least one, more probably two, forms of proteose. I believe the substance soluble in salt solution to be a true globulin, since it so readily assumes an insoluble form, and also because a much larger quantity of the same body was obtained by extracting with 10 per cent salt solution the malt residue remaining after the extraction with water. I also think that at least two forms of proteose are present.

"A part of the proteose was precipitated by alcohol more readily than the albumin, while another part was less readily precipitated. Beside the albumin, globulin, and proteoses, we have also to take account of the 'albuminate' or insoluble forms of the albumin and globulin."

From the fractional precipitate No. 4, preparation No. 15 was obtained by extracting with water, dialysis in water and in alcohol, and treatment with absolute alcohol. This preparation was a very energetic ferment, having a diastatic power of 600, and on this account was more fully studied, with the following results:

"Dissolved in water, this substance gave all the usual proteid reactions, and when heated slowly became turbid at 50°, and gave a flocculent coagulum at 56°. This is exactly the temperature of coagulation of the albumin (leucosin) which I have prepared from wheat, rye, barley, and malt with identical composition and properties. The aqueous extracts of these grains have, moreover, a strong diastatic action on starch. The amount of coagulable albumin in preparation 15 was determined, and found to be 53.2 per cent of the dry substance.

"These facts point strongly to the albumin as being the diastatic substance, yet there are several facts, hard to explain if this be true, which can not be overlooked. Although in general the diastatic power of my preparations was greater the larger the amount of coagulable albumin they contained, I have never yet been able to establish any numerical relations between the two. In no case have I found any diastatic action with solutions free from albumin. Furthermore, the activity of my preparation 15 is such as to require a much greater diastatic power for malt than this shows if its coagulable albumin is the enzym . . .

"The only explanation of this that occurs to me, is that the active diastase is a combination of albumin with some other body, presumably the proteose, which breaks up on heating, yielding coagulated albumin, and that, besides this combined albumin, free albumin is also present, which has no diastatic power, but which is coagulated at the same time. There is no direct evidence, however, that this hypothesis is correct. . . .

"It seems highly probable that diastase is a true proteid, for if we consider the extremely minute quantity of preparation 15 required to produce large amounts of maltose, it is hard to believe that this action is due to some substance adhering to the proteid to the extent of only 3 or 4 per cent at the most. If such were the case it is also remarkable that the enzym should adhere in so much greater quantity to the particular precipitate represented by preparation 15 than to any of the other numerous fractions. If diastase, then, is to be considered as a true proteid, it is evidently either an albumin, a combination of an albumin with a proteose, or a proteose. We have seen that those fractional precipitates which consist largely or wholly of proteose have little or no diastatic action, amylolytic power being manifested most strongly in the fractions containing the most albumin and least in those containing but little, though not in strict proportion to the amount of the albumin. It is to be concluded that the diastatic enzym is most closely related to the albumin named leucosin, and it is not improbable that further careful study will show more clearly what this relation is."

Estimation of sugar, G. OPPERMAN (*Apoth. Ztg., 10 (1895), p. 216; abs. in Jour. Soc. Chem. Ind., 14 (1895), No. 6, p. 605*).—The author suggests the following modification of the method of sugar estimation where the copper oxid is reduced with hydrogen and weighed as copper: After filtering the copper oxid into a tube packed with asbestos, wash it thoroughly and dissolve in moderately strong nitric acid, avoiding a large excess. Precipitate the copper electrolytically, wash, dry, and weigh. Sufficient current may be obtained from a couple of large Daniell cells.—J. P. STREET.

The examination of brandy, X. ROCQUES (*Compt. Rend., 120 (1895), p. 372; abs. in Chem. Ztg., 19 (1895), No. 28, Repert., p. 101*).—The author estimates the total acids by titration with deci-normal NaOH, using phenolphthalein as an indicator, the results estimated as acetic acid; the esters by saponifying with deci normal NaOH, titrating the excess of alkali, and calculating the result as acetic ether; the aldehydes by the colorimetric method, using fuchsin-sulphurous acid and estimating as acetaldehyde; furfurol by the colorimetric method with anilin acetate; fusel oil by the sulphuric acid method after removing the aldehydes by means of phenylen-diamin, estimating as iso-butyl alcohol; free ammonia, amids, and other bases by evaporating with sulphuric acid, and determining by the Kjeldahl method. A fairly accurate conclusion as to the value of the brandy may be drawn from these results, especially from the relation between the esters and the higher alcohols. The results of a number of analyses are given in the original.—W. D. BIGELOW.

The determination of potassium sulphate in wine, L. HUGOUNENQ (*Jour. Pharm. et Chim., ser. 6, 1 (1895), No. 7, pp. 319–351*).—The author states that both grape and fruit wines contain sulphur not in the form of potassium sulphate, but that this salt is formed on ignition. He finds that the organic compounds present in wine have no solvent effect on barium sulphate, and recommends that the sulphuric acid present as sulphate be precipitated with barium chlorid, without previous evaporation and ignition. In case the amount of potassium sulphate in the ash exceeds by as much as 0.2 gm. that obtained by precipitating directly from the wine, the author is inclined to regard it as an indication that the wine was made from raisins or dried fruit.—W. D. BIGELOW.

The detection of salicylic acid in wine, M. SPICA (*Gazz. chim. Ital., 25 (1895), pp. 207–216; abs. in Chem. Centbl., 1895, No. 23, p. 1084*).—The author considers the methods of Girard and Roese the best that have been suggested for this purpose. In these methods the wine is extracted with ether, the ether evaporated, and the residue extracted with petroleum ether, which dissolves only the salicylic acid. The author suggests another method, which he states is both more rapid and more sensitive. He extracts the wine with ether, evaporates the ether from the extract, adds to the residue a drop of nitric acid, warms

the mixture carefully, and then adds 2 to 3 drops of ammonia, when in the presence of salicylic acid, the characteristic yellow color of ammonium picrate appears. One cubic centimeter of water is then added, and the presence of picric acid is confirmed by dyeing fat-free wool.—W. D. BIGELOW.

Estimation of volatile acids in wine, E. BURCKER (*Compt. Rend., 120 (1895), No. 22, pp. 1223–1228*).—The author obtains as high a percentage of volatile acids by distilling with steam as by distilling *in vacuo*, and concludes that the former method is entirely satisfactory. He suggests 0.70 gr. per liter (calculated as sulphuric acid) as the maximum content for French wines and 1.6 gr. per liter for Algerian and Tunisian wines.—W. D. BIGELOW.

New combinations of argon—synthesis and analysis, BERTHELOT (*Compt. Rend., 120 (1895), No. 24, pp. 1316–1319; Chem. News, 72 (1895), No. 1858, pp. 1, 2*).

Concerning a new phosphoric acid ($H_4P_4O_{10}$) and certain of its compounds, F. SCHWARTZ (*Ztschr. anorgan. Chem., 9 (1895), No. 4, pp. 249–266*).

Preparation of phosphoric acid, J. VON RUYMBEKE and W. F. JOBBINS (*Chem. Ztg., 19 (1895), No. 47, p. 1098. American patent 540124, May 28, 1895*).

On the combination of free nitrogen with sulphur and carbon, BERTHELOT (*Compt. Rend., 120 (1895), No 24, pp. 1315, 1316*).

Concerning oxycelluloses, R. W. HAAS and B. TOLLENS (*Liebig's Ann. Chem. und Phys., 286 (1895), No. 3, pp. 296–302*).

Researches on the sugar and glycogen of lymph, A. DASTRE (*Compt. Rend., 120 (1895), No. 24, pp. 1366–1368*).

On the presence of laccase in plants, G. BERTRAND (*Compt. Rend., 121 (1895), No. 3, pp. 166–168*).

Investigations of pectin compounds, R. W. HAAS and B. TOLLENS (*Liebig's Ann. Chem. und Phys., 286 (1895), No. 3, pp. 278–295*).

Combination drying apparatus with constant temperature, K. ULSCH (*Chem. Ztg., 19 (1895), No. 51, pp. 1183, 1184*).

Potassium tetraoxalate as a standard in acidimetry, A. BORNTRÄGER (*Chem. News, 71 (1895), No. 1857, p. 307*).

Note on the "standard" acid solutions, H. D. RICHMOND (*Chem. News, 72 (1895), No. 1858, p. 5*).

Concerning a method of analysis for copper salts, L. SOSTEGNI (*Staz. Sper. Agr. Ital., 28 (1895), No. 3, pp. 167–180*).

On the quantitative determination of fluorin by expulsion as hydrochloric acid, P. JANNASCH and A. RÖTTGEN (*Ztschr. anorgan. Chem., 9 (1895), No. 4, pp. 267–273, figs. 2*).

Simplified Wagner rotation apparatus for the estimation of citrate soluble phosphoric acid, T. OMEIS (*Chem. Ztg., 19 (1895), No. 49, p. 1144*).—For description of original apparatus see *Chem. Ztg., 18 (1894), p. 1934*.

Estimation of organic nitrogen by the Kjeldahl method, H. CHAUSSÉ (*Jour. Pharm. et Chim., ser. 6, 1 (1895), p. 543; abs. in Chem. Ztg., 19 (1895), No. 50, Repert., p. 186*).—The author finds that the mercuric oxid used to accelerate the reaction causes a considerable error. Copper sulphate is suggested as a substitute.—J. P. STREET.

On the fixation of iodin by potato starch, G. ROUVIER (*Compt. Rend., 120 (1895), No. 21, p. 1179; abs. in Rev. Scient., 3 (1895), ser. 4, No. 23, p. 726*).

The copper cyanid reaction in the estimation of glucose, A. W. GERRARD (*Pharm. Jour. and Trans., 25 (1895), p. 913; abs. in Chem. Ztg., 19 (1895), No. 46, Repert., p. 164*).

The estimation of pentosans by Tollens's method, A. STIFT (*Oesterr. ungar. Ztschr. Zuckerind. und Landw., 24 (1895), p. 290; abs. in Chem. Ztg., 19 (1895), No. 46, Repert., p. 165*).—The author gives the results of his examination of a number of different substances for pentosans.

The estimation of alcohol and volatile fatty acids, DUCLAUX (*Ann. Inst. Pasteur, 9 (1895), p. 265; abs. in Chem. Ztg., 19 (1895), No. 46, Repert., p. 165*).

Researches on salicylic acid in wine, M. SPICA (*Staz. Sper. Agr. Ital., 28 (1895), No. 4, pp. 246–256*).

BOTANY.

The injurious effect of nitrogen acids on plants, J. KÖNIG and E. HASELHOFF (*Landw. Jahrb., 23 (1894), No. 6, pp. 1031–1034*).—On account of the numerous sources of nitrogen acids the authors have investigated the effect on plants of the fumes of such acids as commonly escape from the chimneys of factories, etc. They selected for their experiment young plum, apple, cherry, chestnut, oak, and pine trees. The trees were placed under bell jars and subjected to the fumes mixed with air for various lengths of time, the amount of the acid in the air being calculated as "N_2O_4." Different amounts were tried on the different plants and their effect carefully noted. In some cases where the greater amounts were used the leaves quickly became spotted with yellow or brown, some of the more tender leaves becoming quite black. In the case of greater dilution the change took place more slowly, and in some instances no evil effect was noticeable after 16 to 20 hours' treatment. The leaves from some of the trees were analyzed, and it was found that their nitrogen content in nearly every case was increased by the treatment to which they had been subjected, the increase amounting to from 0.48 to 0.77 per cent. The ash content was increased from 0.20 to 4.81 per cent by the experiment. The authors conclude that 1 part of "N_2O_4" by weight in 20,000 liters of air, or 0.05 gm. in 1 cubic meter, will exert a very injurious effect upon young trees, but ordinary air will require 2,000 times its present content of nitrogen acids to become injurious to plants. Comparisons are made of the effect of nitrogen acids with the injuries caused by sulphuric and hydrochloric acid, and the effect of the first is said to be intermediate between the other two.

On the presence of chitin in the cell membranes of mushrooms, E. GILSON (*Compt. Rend., 120 (1895), No. 18, pp. 1000–1002*).—The author reports having found that by treating the skeletons of various mushrooms with concentrated hydrochloric acid, followed with caustic potash at 180° C., products are secured that greatly resemble chitin, and he thinks it probably identical with that substance, which hitherto has been known as an animal product. The mushroom used for the principal experiments was *Agaricus campestris*, and the method of treatment is given in detail. When finally treated with the hydrochloric acid abundant crystals of glycosamin were obtained, while the caustic potash at 180° C. gave mycosin. Analyses of the substance as compared with five analyses of chitin show their probable identity.

Other fungi were examined, and the same substance was found present in *Amanita muscaria*, *Cantharellus cebarius*, *Hypholoma fasciculare*, *Polyporus officinalis*, *P. fumosus*, *Russula* sp., *Boletus* sp., *Tricholona* sp., *Bovista* sp., and *Claviceps purpurea*.

The author states that in all the fungi which he has examined cellulose is absent, but its place is taken by chitin.

On the quantity of water-soluble substances in plants, E. GAIN (*Bul. Soc. Bot. France, 41 (1895), No. 1, pp. 53–67*).—On account of the variations shown in chemical analyses the author has made a study of the soluble substances in a number of kinds of plants grown under different conditions of moisture.

The specimens examined were first dried at 110° C. and weighed, care being taken to prevent error due to the hygroscopic nature of the dry material. The pulverized materials were macerated with cold and with hot water, and the solids determined in the extracts obtained. The methods of manipulation are given in detail, every effort apparently having been made to avoid error.

The percentages of water soluble materials in different parts of the plants examined are given in the following table:

Water-soluble substances in different parts of plants grown in dry and moist soils.

	Plant grown in dry soil.	Plant grown in moist soil.
Helianthus tuberosus:	*Per cent*	*Per cent*
Medullary tissue	7.159	8.133
Woody tissue	3.810	5.100
Roots	4.918	5.689
Linum usitatissimum		
Roots	9.100	11.700
Lupinus albus		
Roots	14.100	15.350
Base of stem	14.180	15.100
Carthamnus tinctoria:		
Root, average of 3 samples	7.590	11.260
Base of stem, average of 3 samples	9.320	16.460
Top of stem, average of 3 samples	14.250	19.420
Brassica napus oleifera		
Root	11.200	12.290
Datura stramonium		
Root	6.050	7.100
Base of stem	12.250	13.100
Top of stem	16.800	17.900
Polygonum fagopyrum		
Whole plant (1893)	19.300	20.510
Base of stem (1892)	19.900	20.400
Middle of stem (1892)	14.200	16.400
Top of stem (1892)	16.900	17.100

From the foregoing table it may be seen that plants grown in moist soils contain a greater percentage of soluble substances in their various parts than those grown in dry soils. If the different parts of a plant be compared, it will be seen that the amount of water-soluble substances is greatest in the tops and usually least in the roots. The amount of such substances seems to be proportional to the quantity of water absorbed and circulating in the plant during its period of growth.

The author, in conclusion, says that it is very important, when comparing chemical analyses of most plants, to consider the different conditions under which they were grown.

Arachis hypogæa, A. S. PETTIT (*Mem. Torrey Bot. Club, 4 (1895), No. 4, pp. 275–296, pls. 3*).—A historical, anatomical, and biological study of the peanut.

Herbaria in their relation to botany, J. P. LOTSY (*Pop. Sci. Monthly, 47 (1895), No. 3, pp. 360–363*).

Mylittopsis, a new genus of Hymenomycetes, N. PATOUILLARD (*Jour. Bot. France, 9 (1895), No. 14, pp. 245–247*).—The author describes *Mylittopsis langloisii*, a new fungus found upon tree trunks in swamps in Louisiana.

On the origin of the names of floral organs, E. ROZE (*Bul. Soc. Bot. France, 42 (1895), No. 3, pp. 215–225*).

Studies in the mechanism of cell formation, L. DRUNER (*Ztschr. Naturw., 22 (1895), No. 2, pp. 271–344; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 3, pp. 172–174*).

On the curving of internodes during growth, R. BARTH (*Inaug. Dissertation Leipzig; abs. in Bot. Ztg., 53 (1895), II, No. 12, pp. 192–194*).

Electricity and plant growth (*Centbl. agr. Chem., 24 (1895), No. 4, pp. 250–254*).—A criticism of certain articles on this subject.

Karyokinesis in the Uredineæ, G. POIRAULT and M. RACIBORSKI (*Compt. Rend., 121 (1895), No. 3, pp. 178–180*).

The germination of some bromeliads, F. MÜLLER (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 175–182, pl. 1*).

Concerning the formation of ice in plants, with especial reference to their anatomical structure, M. DALMER (*Flora, 1895, No. 2, pp. 1–9*).

Concerning the contents and growth of artichoke tubers, G. MEYER (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 184, 185*).

Concerning the origin and life history of starch (*Untersuchungen uber die Stärkekörner, Wessen und Lebensgeschichte der Stärkekörner*), A. MEYER (*Jena: J. Fischer, 1895, pp. 318, pls. 9, figs. 99*).

A preliminary report on the significance of plant sleep, E. STAHL (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 182, 183*).

A preliminary contribution on the physiology of wood growth, K. G. LUTZ (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 185–188*).

On the reciprocal relation between grain and embryo, H. MICHEELS (*Bul. Min. Agr. Belgique, 10 (1894), No. 1, pp. 96–102*).—The author concludes that for each variety examined the size of the embryo increases with the weight of the seed, of 2 grains of equal dimensions the heavier possesses the larger embryo, and that the size of the embryo diminishes less rapidly than the weight of the seed.

The influence of external conditions on the spore formation of Thamnidium elegans, J. BACHMANN (*Bot. Ztg., 53 (1895), No. 5, pp. 107–130, pl. 1*).

On Thismia aseröe and its mycorrhiza, P. GROOM (*Ann. Bot., 9 (1895), No. 34, pp. 327–361, pls. 2*).—A description is given of the mycorrhiza of this tropical plant.

The symbiosis of stock and graft, E. F. SMITH (*Amer. Nat., 29 (1895), No. 343, pp. 615–621*).—A review is given of H. Vöchting's work on the transplanting of plant bodies.

The effect of earth from the subsoil and of sea mud on the root tubercles of leguminous plants, SALFELD (*Deut. landw. Presse, 22 (1895), No. 45, p. 425*).

METEOROLOGY.

Lightning arresters and why they sometimes fail, A. J. WURTS (*Jour. Franklin Inst., 1895, June, pp. 439–456*).—Overhead wires may become charged in 3 ways, viz, by static induction from the clouds, by dynamic induction from a lightning discharge, and by conduction from

the surrounding charged atmosphere. The author inclines to the theory of conduction. During thunderstorms and in many instances during fair weather, the atmosphere becomes charged with electricity at a constantly increasing potential as we recede from the earth.

Poor ground connection, inductive resistance in the ground circuit, defective insulation in the apparatus to be protected, are some of the causes of failure.—A. McADIE.

Minnesota Weather and Crop Review (*Minnesota Weather and Crop Review, 1 (1895), No. 1, pp. 8*).—This is the first issue of a printed monthly review to take the place of the milliographed reports heretofore issued by the State weather service of Minnesota, and contains the observations for April. It marks a distinct advance in the usefulness of the service by placing the climate data of the State in more permanent form and affording a wider distribution. In addition to publishing the regular meterological data for the State from month to month, it is the purpose of the editor to make the review a medium for the diffusion of information relating to the science of the weather in general.—O. L. FASSIG.

Frost and plants, L. H. PAMMEL (*Monthly Weather Review Iowa Weather and Crop Service, 6 (1895), No. 5, p. 10*).—Notes on the sensitiveness of different plants to frost, with a statement of the effect of the last freeze on a large variety of plants.

The path of lightning in trees, K. E. F. SCHMIDT (*Abhandl. Natur. Ges. Halle, 19, pp. 4, pl. 1*).—The author gives results of certain experiments made with a view of determining the relations between the path of the lightning and the movement of the sap in trees. An excellent photograph of an oak struck by lightning is given, showing 3 distinct channels in the wood, followed by the lightning.—A. McADIE.

Meteorological observations at Massachusetts Hatch Station, F. L. WARREN (*Massachusetts Hatch Sta. Met. Bul. 77, pp. 4*).—The usual summaries of observations during May, 1895.

Meteorological report, 1894, J. DRYDEN (*Utah Sta. Rpt. 1894, pp. 34-39*).—Daily and monthly summaries of observations on temperature, relative humidity, and precipitation during the year. The annual summary is as follows: *Temperature* (degrees F.), highest 94 (August 25 and 27), lowest 11 (February 4), mean 45.42; *precipitation* (inches), 14.48.

SOILS.

On the accumulation in the soil of copper compounds used in combating parasitic diseases of plants, A. GIRARD (*Compt. Rend., 120 (1895), No. 21, pp. 1147-1152*).—The question of the effect of the long-continued use of copper fungicides on the quality and quantity of crops has been investigated by the author during the past 3 years. Numerous authors have considered the same question, and the prevailing opinion is that the accumulation of copper in the soil has but little effect on subsequent crops.

A plat of ground was carefully selected and subdivided so as to have the treated and check plats of equal fertility, and the same culture was given each duplicate lot. The amount of copper annually taken up by the soil when cultivated with grapes or potatoes was ascertained from experiments with a Bordeaux mixture containing 2 per cent of copper sulphate, and from this data the quantity represented by a century of

such accumulation was computed and added to the treated plats. The amount added was at the rate of 1,500 kg. per hectare, all of which was applied at once. Comparisons were made of the growth and production of wheat, oats, clover, potatoes, and sugar beets. The harvest of 1892 was not tabulated by the author, it being thought best to omit this from consideration, although the growth and yield were essentially the same on both treated and check plats. The results of the experiments of 1893 and 1894 are tabulated below:

Influence of accumulated copper on yield of crops.

	1893.		1894.	
	Check plats.	Treated plats.	Check plats.	Treated plats.
	Kg.	*Kg.*	*Kg*	*Kg.*
Wheat,[1] straw	17.0	15.0		
Wheat, grain	8.0	12.2		
Oats, straw	33.0	26.0	39.2	31.4
Oats grain	12.8	17.3	15.4	15.7
Clover, air dry	20.0	22.0	17.0	21.0
Potatoes[2]			27.0	27.0
Sugar beets	18.2	18.8	26.0	26.0

[1] Wheat destroyed by birds in 1894. [2] Potatoes failed in 1893 owing to dry season.

The starch content of the potatoes was the same (12 per cent) for those grown on the treated and untreated plats. The sugar beets grown in 1894 on the untreated plats contained 14.15 per cent of sugar and those grown on the treated plats 15.04 per cent.

In another plat a miscellaneous collection of garden crops was grown, the product of which was not weighed, but there appeared no perceptible difference between those grown on treated and on check plats.

The author concludes that the amount of copper accumulating in the soil from the spraying of grapes or potatoes will not reduce the yield of subsequent crops to any considerable degree.

Tests were made for copper in the plants grown in the treated soils, but the quantity found was insignificant, only 2 out of 20 analyses giving enough to be weighed.

From the experiments of the author it seems that a century of accumulated copper in the soil did not injuriously affect the quality or quantity of the crop.

Chemical analysis a reliable guide to the agricultural value of soils, E. W. HILGARD (*Amer. Agr. (middle ed.), 1895, Aug. 10, p. 90*).

Cultivation of the soil and nitrification, P. P. DEHÉRAIN (*Rev. Scient., 3 (1895), ser. 4, No. 25, pp. 779–787*).

Studies in subsoiling, H. R. HILTON (*Home, Field, and Farm, 3 (1895), No. 6, p. 81*).—A popular article explaining the effect of subsoiling on soil water and giving the experience of Kansas farmers.

The profitable cultivation of marsh lands, C. VON FEILITZEN (*Svenska Mosskultur Fören. Tidskr., 1895, pp. 29–49*).

FERTILIZERS.

On methods to determine the availability of organic nitrogen in fertilizers, S. W. JOHNSON and E. H. JENKINS (*Connecticut State Sta. Rpt. 1894, pp. 73–112, pls. 7*).

Synopsis.—Tests of relative availability of the nitrogen in nitrate of soda, dried blood, fish scrap, tankage, ground horn and hoof, cotton-seed meal, linseed meal, castor pomace, leather (raw, steamed, and acidulated with sulphuric acid), and of the organic nitrogen of 27 brands of fertilizers were made in vegetation experiments with corn in pots, with pepsin solution, and under putrefaction. The solubility of the nitrogen of the first 11 materials in pepsin solution "was a fairly good measure of the relative availability of the nitrogen to the corn plant" in vegetation experiments, but the results under putrefaction showed no satisfactory agreement with those of either of the other methods. The results obtained by the pepsin-digestion method on the water-insoluble organic nitrogen of mixed fertilizers varied widely from those obtained in the pot experiments.

The work of the station in this line during 1894 was a continuation and extension of that carried on in former years.[1] It consisted chiefly of vegetation experiments in pots with various nitrogenous materials, following in the main Wagner's method, but in addition determinations of solubility in pepsin-hydrochloric acid and under putrefaction were made.

In the vegetation experiments the availability of nitrogen in nitrate of soda, dried blood, fish scrap, tankage, ground horn and hoof, cotton-seed meal, linseed meal, castor pomace, leather (raw, roasted, steamed, and acidified with sulphuric acid), and of the water-insoluble organic nitrogen in 27 brands of commercial fertilizers, found in the Connecticut market, was tested in pots of galvanized iron 8 in. in diameter and 12 in. deep, filled with an artificial soil (10 lbs.) consisting of sifted anthracite coal ashes mixed with 3 per cent of ground peat moss.

With the exception of 14 pots the soil of every pot received 15 gm. of calcium carbonate, 4.4 gm. of potassium sulphate, 1.5 gm. of dicalcium phosphate, and 1.2 gm. of "concentrated phosphate." Hence the soils of each contained, in addition to the small amounts of plant food furnished by the ashes, 2.04 gm. of potash, 1.18 gm. of phosphoric acid, and 8.54 gm. of lime, besides variable amounts of the less important mineral constituents. The peat used contained 0.64 per cent of nitrogen and the ashes 0.06 per cent.

The nitrogenous fertilizing materials were supplied in amounts furnishing 0.8, 1.6, 2.4, or 3.2 gm. of nitrogen per pot.

Carefully selected seed of Hickox Improved Sweet Corn were sprouted and 3 kernels planted in each pot. In all the pots except 6, which were used to test the effect of varying amounts of water (30 to 80 per cent of that required for saturation), the water content was kept between 30

[1] See Annual Reports of the station for 1885, p. 115; 1886, p. 80; 1893, p. 218 (E. S. R., 6, p. 130).

and 50 per cent of the water-holding capacity of the soil. To all of the pots except 8 a small amount of water extract of garden soil was added. Of the 8 not so treated 5 received 100 gm. of garden soil and 3 were not inoculated. The pots were kept in a glass vegetation house modeled after that designed by L. H. Bailey for the New York Cornell Station.[1]

Since this method of determining the availability of nitrogen is reliable "only when it is certain that the nitrogen of the fertilizer is deficient relatively to the other elements of plant food," a series of pots in the above experiments was used to test the effects on the yield of normal amounts of potash (2.04 gm.) and phosphoric acid (1.18 gm.) and of 1¼ and 1½ normal amounts of these substances.

Detailed tabulated data regarding crop and nitrogen in crop are given for each experiment which was successfully carried through.

The results may be summarized as follows:

"(1) The inoculation of the artificial soil with either soil extract or garden soil was without effect, and therefore unnecessary.

"(2) For the assimilation of nitrogen the 'normal' water supply was sufficient or in excess when 0.8 gm. or 1.6 gm nitrogen was used in the fertilizer. There are no data to demonstrate whether with 2.4 or 3 2 gm. of nitrogen the water supply was deficient.

"(3) For maximum crop production the water supply was probably scarcely sufficient when 0.8 gm. nitrogen was used, and was no doubt somewhat deficient when 1.6 gm. nitrogen was employed.

"(4) For the assimilation of nitrogen the 'normal' quantity of potash was certainly in excess of the plant requirements when 0.8 gm nitrogen was used in the fertilizer and was probably also in excess when 1.6 gm. nitrogen was present

"(5) For maximum crop production potash was deficient in all cases.

"(6) In the following experiments no conclusions as to the availability of nitrogen are safe where more than 1.6 gm. of nitrogen was used in the fertilizer

"(7) The quantity of nitrogen taken up by the crop is a fairer measure of its availability than the total weight of the crop. . . .

"Under the conditions of this experiment, of the organic forms of nitrogen, castor pomace B was the most available, 85 per cent, when nitrate of soda equals 100 per cent. Somewhat less available was the nitrogen of linseed meal, 80, and of blood, 77 per cent. Next came cotton-seed meal, 76; castor pomace A, 74, and horn and hoof, 72 per cent. Last came dry fish, 70, and tankage, 68 per cent. . . .

"It appears that raw leather finely pulverized was absolutely inert under the conditions of this experiment, that steamed and roasted leather were so slowly available as to be nearly worthless, but that the nitrogen of leather which had been heated with more than its own weight of oil of vitriol was as available as that of dry fish or horn and hoof. This last result of a single test needs confirmation.

"The nitrogen in the mixture of leather and garbage was less than half as available as that of fish or horn and hoof."

A series of pots was devoted to tests of the value of the organic nitrogen of 27 brands of fertilizers. The organic matter was separated from ammonia salts and nitrates by the following method:

"Two hundred and fifty grams of each fertilizer was shaken in a fruit jar with 300 cc. of cold water, and after standing some time 200 cc. of the liquid was poured off through a paper filter, 200 cc. of water was added to the residue in a jar, shaken,

[1] Amer. Gard., 1893, Feb., p. 95.

let stand until nearly clear, and poured off as before. This process was repeated 6 times.

"The residue was then brought on the filter and washed sufficiently to collect all the solid particles. The residue was then dried, separated from the filter, weighed, ground and sifted to pass circular holes 1/25 in. in diameter."

A considerable proportion of the organic nitrogen was found to be removed by this process.

"The vegetation tests were therefore made only on that portion of the organic nitrogen which was undissolved by cold water. . . .

"In 15 of the fertilizers the part of the organic nitrogen which was undissolved by cold water appeared to be rather less available than that of dried blood.

"If the availability of nitrogen in nitrate of soda is called 100, and of that of blood 77, then the availability of the nitrogen of these 15 fertilizers is between 60 and 70.

"In one other case the relative nitrogen availability was 78, in 2 others between 55 and 60, in 4 others between 50 and 55, in 2 others between 45 and 50, in 2 others between 40 and 45, and in 1 other between 35 and 40."

The relative pepsin solubility of the nitrogen in the 13 materials employed in the vegetation experiments was determined by the method used in previous investigations.[1] The following table gives the results of these determinations, together with the relative availability of the nitrogen as determined in the vegetation experiments (nitrate of soda being 100):

Availability of nitrogen in different fertilizing materials.

	Nitrogen soluble in pepsin	Relative availability in pot experiments.	Relative solubility in pepsin solution.
	Per cent.		
Dried blood	93.3	77.1	77.1
Castor pomace B	86.0	85.2	76.5
Linseed meal	88.9	79.6	75.6
Cotton seed meal	89.3	75.5	73.8
Castor pomace A	81.0	73.9	71.0
Horn and hoof	35.0	72.1	28.9
Dry fish	68.1	69.8	66.9
Tankage	91.6	67.9	56.2
Leather and garbage	41.0	30.8	33.8
Raw leather	8.6	......	7.1
Steamed leather	20.3	6.2	16.8
Roasted leather	8.5	6.3	7.0
Dissolved leather	5.3	79.3	5.3

"In general, therefore, the solubility of the nitrogen of these samples in pepsin solution was a fairly good measure of the relative availability of the nitrogen to the corn plant under the conditions of our vegetation experiment.

"The difference between the results obtained with castor pomace B (8.7) is hardly significant. The difference in case of tankage (11.7) is more pronounced.

"In the case of horn and hoof the relative availability of the nitrogen is not indicated in the least by its solubility in pepsin solution. The former is represented by the figure 72.1, the latter by 28.9.

"The same is true of the dissolved leather, where the availability of the nitrogen is represented by 79.3, the solubility in pepsin by 5.3. . . .

"Previously to digestion with pepsin solution the gram portion of dissolved leather was digested for an hour with 250 cc. of 0.2 per cent hydrochloric acid and then washed copiously with cold water. While our experiments have shown (Re-

[1] Annual Report of the station for 1893, p. 218 (E. S. R., 6, p. 131).

port, 1885, p. 121) that a very large amount of gypsum interferes considerably with the solvent action of pepsin-hydrochloric acid, it was believed that this preliminary treatment would nearly, if not entirely, remove the excess of gypsum. The tests prove, however, that the nitrogen is almost entirely insoluble in pepsin solution."[1]

The solubility in pepsin of the water-insoluble organic nitrogen of 6 of the mixed fertilizers used in the vegetation experiments was determined with the following results:

Availability of water-insoluble organic nitrogen of mixed fertilizers.

	Nitrogen soluble in pepsin	Relative availability	Relative solubility in pepsin solution.
	Per cent.		
1	75.3	52.9	62.2
2	64 0	51.4	52 8
3	73.2	49.7	60.5
4	67 4	48 4	55.7
5	55 0	39.6	45.4
6	83.2	42.9	68 7

"If there were absolute agreement between the tests of relative nitrogen availability and relative nitrogen solubility in pepsin solution, the figures in the third column should be identical with the corresponding figures in the second column. There appears to be no satisfactory agreement between the two."

The same nitrogenous fertilizing materials used in the above experiments were compared as regards the solubility of their nitrogen under putrefaction. The method employed was the same as in previous investigations.[2] The results are given in the following table.

Relative availability of nitrogen in the soil, by pepsin digestion, and by putrefaction.

	Relative availability in pot experiments	Relative solubility— In pepsin solution.	Relative solubility— By putrefaction.
Dried blood	77.1	77.1	77.1
Castor pomace B	85.2	76.5	70.8
Linseed meal	79.6	75 6	64 4
Cotton-seed meal	75.5	73 8	62.1
Castor pomace A	73.9	71 0	71.8
Horn and hoof	72 1	28 9	40.4
Dry fish	69 8	66.9	70 9
Tankage	67 9	56.2	62.1
Leather and garbage	30 8	33.8	49.8
Raw leather	. .	7.1	24.8
Steamed leather	6 2	16.8	23.7
Roasted leather	6 3	7 0	10.3
Dissolved leather	79 3	5.3	35 4

"The relative solubility in pepsin solution has this year agreed much more nearly with the relative availability as determined by vegetation tests than has the relative solubility by putrefaction."

[1]Lindsey treated ground leather with about double its weight of sulphuric acid (50° B.) until decomposition was complete, dried the mass with bone ash or floats, and digested 5 gm. of this mixture, which had been washed with water until soluble phosphoric acid was removed, in pepsin solution in the usual way. He found that 70 per cent of the nitrogen was dissolved by the pepsin solution (E. S. R., 6, p. 24). Recent pot experiments by Lindsey indicate that, rating nitrogen in nitrate of soda at 100, nitrogen in dissolved leather should be rated at about 60.

[2]Annual Report of the station for 1893, p. 228 (E. S. R., 6, p. 131).

Fertilizers (*Connecticut State Sta. Rpt. 1894, pp. 1-72*).—This includes the text of the State fertilizer law with comments; a list of fertilizer manufacturers complying with the law; notes on sampling; explanations concerning the analysis of fertilizers and the valuation of their active ingredients; a review of the fertilizer market, and analyses of 275 samples of fertilizing materials, including nitrate of soda, saltpeter waste, sulphate of ammonia, dried blood, dry ground fish, ground horn and hoof, cotton-seed meal, castor pomace, gluten feed, tankage, bone, odorless phosphate, dissolved boneblack, acid phosphate, sulphate of potash, muriate of potash, sulphate of potash and magnesia, cotton-hull ashes, wood ashes, limekiln ashes, sheep manure, and home-mixed and factory-mixed fertilizers.

"Cotton-seed meal is the cheapest supply of available organic nitrogen now in market. Experience demonstrates that it is very prompt to act and quite odorless.

"Its use as a fertilizer seems to be mostly confined at present to tobacco, but it is equally valuable for other crops, and at present rates deserves to be used extensively to replace the higher priced nitrogen of dried blood, tankage, and ground bone. . . .

"The average cost of the 17 samples of bone manure was $33.59 and the average valuation $32.01. The valuation during this year has therefore been rather lower than is justified by the market prices. . . .

"The average cost of the nitrogenous superphosphates is $32.93, the average valuation is $23.30, and the percentage difference 41.3. . . .

"Of the 53 brands [of nitrogenous superphosphates and guanos] here reported 16 are below their minimum guarantee in respect of 1 ingredient and 2 in respect of 2 ingredients. That is, more than one fourth of all the nitrogenous superphosphates in our market contain less of 1 or of 2 ingredients than they are claimed to contain. . . .

"Of the 60 brands of special manures analyzed 26 are quite below the manufacturer's minimum guarantee in respect of 1 ingredient, 4 are below in respect of 2 ingredients, and 1 in respect of all 3 ingredients. Fully one-half, therefore, are below the manufacturer's guarantee.

"The average cost per ton of the special manures has been $38.13, the average valuation $28.62, and the percentage difference 33.2 per cent. Last year the corresponding figures were: Average cost, $37.76; average valuation, $29.35; percentage difference, 28.6 per cent. . . .

"The average cost of 7 home mixtures, including cost of mixing, was $36.76 and the average valuation $31.70 per ton. The percentage difference between cost and valuation was 16. In factory-mixed fertilizers this percentage difference has been on the average 41.3 for nitrogenous superphosphates and 33.2 for special manures during the last season. . . .

"The price of 'actual potash' in cotton-hull ashes has ranged from 5.4 cts. to 15.5 cts. per pound, the average being 8.3 cts.

"Formerly these ashes were one of the cheapest sources of available potash; they are now the most expensive source in market."

From the replies to a circular sent out by the station to each fertilizer manufacturer whose goods were entered for sale in the State it is estimated "that the total amount of commercial fertilizers sold within the State annually can not be less than 22,500 tons."

"This statement covers only factory-mixed goods, bone, mixtures of bone and salts, and fertilizer chemicals, all of which are handled by manufacturers of mixed goods.

It does not, however, by any means show the total quantity of fertilizers used in the State.

"It does not, for instance, include unleached wood ashes, a favorite fertilizer with fruit growers, cotton-hull ashes or tobacco stems, and only a small part of the cotton-seed meal, which is used in the tobacco-growing region in very large amount. It is impossible to estimate how much of the materials above named are annually bought."

Commercial fertilizers, H. A. HUSTON and W. J. JONES, Jr. (*Purdue Univ. Spec. Bul., 1895, May, pp. 8*).—This bulletin includes statistics of the fertilizer industry in Indiana; a brief discussion of the phosphates found in the Indiana market, especially of Tennessee and Virginia phosphates; notes on valuation, and tabulated analyses of 310 samples of fertilizers.

"The estimated sales of commercial fertilizers in Indiana during the year 1894 amounted to 35,000 tons, a decrease of 3,000 tons from the estimated sales in 1893. This 35,000 tons of fertilizer consisted of 10,900 tons of bone, raw and steamed; 15,600 tons of 'complete' fertilizer, that is, fertilizer containing nitrogen, phosphoric acid and potash; 4,200 of ammoniated phosphates; 1,000 tons of phosphate and potash, and 3,300 tons of acid phosphate. . . .

"The wheat crop removes from the soil $2\frac{1}{3}$ times as much nitrogen as phosphoric acid and $1\frac{1}{3}$ times as much potash as phosphoric acid. . . . For every pound of nitrogen contained in the fertilizing material used in the state in 1891 there was 7.3 lbs. of phosphoric acid, and for every pound of potash there was 12.8 lbs. of phosphoric acid. It will be seen that in the fertilizer material used the order of things is reversed. The same would appear in even greater degree if we should consider the corn crop. . . . The differences are yearly becoming relatively greater. The cause of this change in plant-food ratios is probably to be found in trade considerations rather than in the demand of the farmer." . . .

Commercial fertilizers, J. L. HILLS and B. O. WHITE (*Vermont Sta. Bul. 47, pp. 25-60*).—This includes a brief discussion of the principles underlying the use of fertilizers; information regarding the materials used in commercial fertilizers; notes on the specific action of fertilizers on plant growth, and on the selection, purchase, and use of fertilizers; explanations of terms used in analyses; a comparison of the values of fertilizers licensed in 1894 and 1895; and tabulated analyses of 118 samples of fertilizing materials, including wood ashes, muck, and mixed fertilizers.

"Of the 92 brands analyzed, 60, or two-thirds, are above guaranty in nitrogen, available phosphoric acid, and potash; 26, or a little more than one-fourth, are deficient in a single ingredient; 7, or one-twelfth, are deficient in 2 ingredients. Of the 33 brands found deficient 29 are but slightly so or show by their analyses imperfect mixing at the factory. They contain a sufficient excess of other ingredients to afford an equivalent money value. It is safe to say that 95 per cent of the brands sold in the State this year contain the commercial equivalent of their guaranties.

"The average composition of 47 brands sold in Vermont in 1894 and 1895 differs but slightly, the increase in valuation being but 34 cts. The average goods are of poorer quality than those sold before 1894. Owing to lower prices for mixed goods and the slight increase in valuation of the average of all goods, plant food is bought this year in commercial fertilizers as low as at any time within the past 11 years.

"Seventeen samples of ashes varied from 3.36 to 9.53 per cent soluble potash and from 1.47 to 5.23 per cent phosphoric acid. The prices for these goods were not in accordance with their composition."

Composition and use of fertilizers, G. W. SHAW (*Oregon Sta. Bul. 36, pp. 59–76*).—A popular discussion of the following topics: Foundation laws of modern agriculture, soil and plant-food constituents, the object of fertilizers or manures, classification of fertilizers, the elements and their relation to fertilizers, direct nitrogenous fertilizer materials, potash fertilizing ingredients, phosphorus, fertilizing materials produced on the farm, condition of the fertilizer market, and needs of Oregon soils.

"Experiments in the field have been very limited in this State, yet based upon the ordinary methods of judging deficiency of plant food in soils, chemical analysis of a large number of soils seems to indicate a limited amount of potash in the Willamette Valley soils, and this would doubtless be the first ingredient needed on the lowland, and the higher land seems to point toward a need of phosphoric acid. These results must, however, be taken as only indicative, although these chemical results have been verified in instances where the experiment has been tried. The loams of Clackamas County have shown a good supply of potash, and a number of Lane County soils have shown a high content of phosphoric acid.

"There is a common idea abroad that our soils are deficient in lime, yet the analysis of a large number of soils has not shown that to be true. . . .

"Of the soils of eastern Oregon but a limited number of analyses have been made, but acting upon experience in other States having similar climatic conditions, and taking into account the origin of the soils of that part of the State, we can say that the basaltic rocks would naturally produce a soil well supplied with phosphoric acid, and from this reason it will doubtless be found that when the soils fail it will be rather on the side of potash than phosphoric acid."

The world's consumption of fertilizers—phosphates, MAIZIÈRES (*L'Engrais, 10 (1895), No. 21, pp. 191, 192*).—The world's production of phosphates is stated to be as follows:

The world's production of phosphates.

	1894.	1895 (estimated).
	Tons.	*Tons.*
Florida	589,497	625,000
South Carolina	500,000	575,000
Tennessee	10,000	50,000
Canada	8,200	8,000
Algeria	53,231	130,000
France	450,000	425,000
Belgium	225,000	225,000
England	5,000	5,000
Germany	15,000	15,000
Antilles, islands of Oceanica, etc., including phosphatic guanos	50,000	40,000
Norway, Russia, Spain, and other countries	30,000	30,000
Total	1,935,928	2,128,000

On the indirect fertilizing of soils by means of bisulphid of carbon, G. GASTINE (*Prog. Agr. et Vit., 12 (1895), No. 21, pp. 629–638*).

Utilization of the sewage water of Rheims, G. HEUZÉ (*Jour. Agr. Prat., 59 (1895), No. 28, pp. 43–47*).

Anthracite coal as a fertilizer, S. RAY (*Gard. Chron., ser. , 18 (1895), No. 447, pp. 73, 74*).—The author doubts the value of dust from anthracite coal as a substitute for soot.

The world's consumption of fertilizers—superphosphate, MAZIÈRES (*L'Engrais, 10 (1895), No. 25, pp. 589, 590*).

Experiments on the activity of barnyard manure and of its various constituents (*Ztschr. landw. Cent. Ver. Sachsen, 1895, No. 6, pp. 202–208*).

On the causes of the loss of nitrogen in decomposing organic matter, especially in farmyard manure and urine (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 24, pp. 342–344*).

On the manufacture and application of peat litter, A. DAL (*Tidskr. norske Landbr., 2 (1895), pp. 153–168*).

Is stable manure injurious in moor culture? (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 184, 185*).

Trade values of fertilizing ingredients in raw materials and chemicals (*New York Cornell Sta. Bul. 92, pp. 208, 209*).—These figures are for the season of 1895, and for comparison the figures for 1894 are also given.

A new process for converting natural phosphate into phosphatic fertilizers similar to slag, D. LEVAT (*L'Engrais, 10 (1895), No. 24, p. 568*).—A patented process in which it is proposed to fuse natural phosphates with suitable fluxes containing fluorid of calcium, feldspar, silicates, potash salts, etc., and thus prepare a product containing phosphoric acid in the tetrabasic form as in slag, besides a certain amount of potash.

The citrate solubility of Thomas slag (*Landw. Centbl. Posen, 23 (1895), No. 27, pp. 157, 158*).

Influence of heavy manuring with Chile saltpeter on potatoes and beets (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 185, 186*).

Fertilizer experiments conducted by Smaalenene Agricultural Society (Norway) during 1893, F. H. WERENSKIOLD (*Norsk Landmandsblad, 14 (1895), pp. 25–27*).

Report of the agricultural experiment station of Hohenheim on the control of fertilizers in Wurtemberg for the year ending April 30, 1895 (*Württ. Wochenbl. Landw., 1895, No. 26, pp. 375–378*).

Annual report of the Chemical Control Station at Halmstad (Sweden) for the year 1894, E. LYTTKENS (*Halmstad: 1895, pp. 10*).

Report of the Chemical Control Station at Christiania, Norway, F. H. WERENSKIOLD (*Kristiania: 1895, pp. 58*).

FIELD CROPS.

Observations on the growth of maize continuously on the same land, E. H. JENKINS (*Connecticut State Sta. Rpt. 1894, pp. 245–253*).

Synopsis.—Yield in dry matter of plats differently fertilized; analyses of kernels, cobs, and stover grown with different manures and fertilizers; gain or loss of fertilizing ingredients in the soil by 7 years of manuring and cropping with corn. The plats annually fertilized with cow manure and hog manure afforded practically identical yields. The kernels grown on the unfertilized plat contained smaller percentages of albuminoids but more fiber and nitrogen-free extract than the grain produced on the manured plats.

This is a continuation of work reported in the Annual Report of the station for 1893 (E. S. R., 6, p. 136). In 1890 and in each subsequent year one plat was fertilized with 10 cords per acre of cow manure, another with 13½ cords of hog manure, and a third with 1,700 lbs. of commercial fertilizers, another plat being left unfertilized.

The yields per acre of dry matter in 1894 on plats differently fertilized were as follows:

Yield per acre of dry matter in corn crop, 1894.

	Cow manure	Hog manure	Chemical fertilizers.	No fertilizer.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Kernels	1,770.4	1,686.4	1,761.1	1,142.1
Cobs	324.0	353.6	359.4	231.3
Stover	1,927.3	1,805.4	1,777.1	1,317.9
Total	4,020.7	3,845.4	3,897.6	2,691.3

The relative yields of dry matter for 5 years, taking as 100 the total yield of dry matter on the plat fertilized with cow manure, averaged with hog manure 100.6, with commercial fertilizers 88, and on the unfertilized plat 59.7.

Taking the average for 5 years the dry matter of the kernels produced on the unfertilized plat contained smaller percentages of albuminoids, ash, and fat, but more fiber and nitrogen-free extract than on the plats receiving cow and hog manure. The kernels on the plats receiving commercial fertilizers contained less ash and albuminoids but more nitrogen-free extract than on the plats fertilized with farm manures.

During 7 years' cropping with corn (including 2 years in which commercial fertilizers were applied to all the plats), the manures supplied to the soil the following amounts per acre of fertilizing ingredients in excess of the quantities removed by the crops:

Excess of fertilizing ingredients in manures applied over amounts removed by 7 crops of corn.

	Nitrogen	Phosphoric acid	Potash.
	Pounds	*Pounds.*	*Pounds.*
With cow manure	934.6	680.7	711.7
With hog manure	1,571.0	2,898.0	101.3
With commercial fertilizers	418.6	831.4	158.7
Unfertilized (except in 1888 and 1889)	[1]—287.5	65.4	[1]—64.3

[1] Loss.

Corn, S. M. Tracy and E. R. Lloyd (*Mississippi Sta. Bul. 33, pp. 61–77*).

Synopsis.—This is a summary of results relating to corn culture obtained during several years at the Mississippi Station and at other stations. The topics treated are methods of preparing land; deep and shallow cultivation; cutting, topping, and stripping; early and late varieties; nutritive value of different varieties; selection of seed; yellow and white varieties; qualities desired in a variety; and insects injuring corn.

At the station the most satisfactory method of preparing land was to make a bed 8 ft. wide for 2 rows, with water furrows in the alternate spaces.

Shallow cultivation proved superior to deep culture.

"We have examined the records of 116 such tests made at 13 different stations and find that 61 tests of deep cultivaton gave an average yield of 64.9 bu. per acre, while 55 tests of shallow cultivation gave an average of 74.7 bu., a difference of 9.8 bu. per acre, or more than 15 per cent in favor of shallow cultivation."

The value of the tops, when topping was practiced, did not compensate for the resulting reduction in the yield of corn.

"The records of 7 other stations where similar work has been done show the average yield of the fields which were topped to have been 68.3 bu. per acre, while the untouched check plats averaged 81 3 bu., a loss of 16 per cent from topping.

"In the work which has been done at this station stripping the leaves has caused an average decrease of over 18 per cent in the yield of corn, which has made the fodder cost $14 per thousand bundles besides the labor of pulling."

At the station early varieties averaged 31.7 bu. of corn per acre, while late varieties yielded 41.4 bu. "Our best yields have been from varieties which require 140 to 170 days for their full maturity."

Analyses are quoted which indicate that dent and flint and yellow and white varieties have practically the same composition, and that locality exercises no marked influence in this respect. The method of selecting seed corn is described.

No advantage was obtained in rejecting kernels from any part of the ear, as tip or butt.

As the result of variety tests extending over 5 years, 25 white varieties in 75 tests averaged 43 bu. per acre, while 20 yellow varieties in 63 tests afforded only 38.2 bu.

"The published records of similar work done at other stations have been examined very carefully, and have been found to correspond very closely with the results secured at this station. . . .

"In the preparation of the following summary the 'flint' and 'flour' varieties have been excluded as having no interest for Mississippi corn growers; and the records of varieties of which the color is not given, or which have made yields of less than 20 bu. per acre have been omitted. The exclusion of these varieties makes the figures from the several stations vary slightly from those given in the different reports but does not change the final result.

"With that basis, we find the results of the work of the 7 stations which have made more than 50 tests each to be as follows:

Relative yield per acre of white and yellow varieties of corn.

	White.		Yellow.		Excess.	
	Number of varieties.	Yield per acre	Number of varieties.	Yield per acre.	White.	Yellow.
		Bushels.		*Bushels.*	*Bushels.*	*Bushels.*
Arkansas	14	36.7	14	36 6	0.1	....
Illinois	54	63.1	101	62 0	1.1	....
Indiana	16	54.8	28	56 3	....	1.5
Kansas	53	54.2	67	53 1	1.1	....
Louisiana	30	47.5	9	39.7	7.8	....
Mississippi	25	43.0	20	38.7	4.3	....
Ohio	25	55.4	34	51.3	4.1	....
Total or average	217	50.7	273	48.2	2.5	....

"These figures show that in a total of 1,267 tests with 490 varieties the average yield of 217 white varieties has been 2.5 bu. per acre in excess of the yield of 273 yellow varieties; and that at only 1 of the 7 stations making these tests have the yellow varieties given the better average yield. At 6 of the 7 stations some one white variety has given the best yield, and of the 35 varieties named as giving the best yields at the different stations, 24 are white and only 11 are yellow. If only the varieties which have been tested two or more times at each station are considered, the average yield of the white varieties has been 50.9 bu. per acre, against 47.6 bu. for the yellow varieties."

The characteristics of a variety adapted to Mississippi are given.

The two insects most troublesome on young corn plants were the corn worm (*Heliothis armigera*) and bud worm (*Diabrotica 12 punctata*); for the latter no remedy is given; for the former the authors advise pinching the lower part of the stem of the wilted plants, thus killing the worms and reducing the danger from later broods, which would attack the ear.

Field experiments with fertilizers on corn, potatoes, and tobacco (*Kentucky Sta. Bul. 55, pp. 39–53*).—These are in continuation of experiments reported in Bulletin 45 of the station (E. S. R., 4, p. 716). The experiments with corn and potatoes occupied the same tenth-acre plats as in previous years. Tobacco was grown on a field which had previously been in grass and highly fertilized with tobacco stems. On corn and potatoes muriate of potash, nitrate of soda, and superphosphate were applied alone and in various combinations. On tobacco the fertilizers used were nitrate of soda, double superphosphate, and carbonate of potash and magnesia in different combinations.

On corn muriate of potash alone and a mixture of muriate of potash and nitrate of soda were the only fertilizers that afforded a profit. On potatoes and on tobacco the largest yield was obtained on the plat receiving a complete fertilizer: the yield of potatoes with muriate of potash was greater than with either nitrate of soda or superphosphate. Tabulated data give the yield of corn and potatoes for each year of the test and the meteorological conditions for 1894.

Fertilizer experiments on hemp (*Kentucky Sta. Bul. 55, pp. 54, 55*).—One hundred and sixty pounds of nitrate of soda, 140 lbs. of double superphosphate, and 160 lbs. of muriate of potash per acre were applied. On all the fertilized plats the yield of fiber was greater than on the unfertilized plats. The highest yield, 1,170 lbs., was afforded by a mixture of muriate of potash and nitrate of soda. "The results strongly indicate that nitrogen and potash were needed on the plats for hemp."

Sowing leguminous plants alone and in mixtures, SCHULZ-LUPITZ (*Abs. in Deut. landw. Presse, 22* (*1895*), *No. 30, pp. 285, 286, figs. 2*).—**After long experience it has been found more profitable on the light soils of Lupitz to plant several leguminous plants in a mixture rather than to sow each alone. By this course complete failure of crop is avoided. In certain seasons, however, when weather conditions are**

especially favorable to one species, that one, sown alone, yields more than the mixture.

The advantages of mixed seeding noted by the author are the following: In a mixture of different species the space both above the surface of the ground and within the soil is most completely occupied; the roots of some species feed deep, of others shallow. External influences, as insect enemies and fungus diseases, are not so completely destructive as is sometimes the case when a single crop is sown, for generally these injuries are not common to all the species in a mixture.

In deciding on the constituents and proportions of a mixture of leguminous plants the character of the soil should be considered. On soils of slight capacity for retaining water the mixture should contain a large percentage of the seeds of deep-rooted plants. When the soil is less inclined to suffer from drought shallow-rooted plants, as serradella, peas, and vetches, may find a place. For gravelly soils the author regards a mixture containing lupines as the best.

The yield and nitrogen content of several mixtures of leguminous plants—of which the separate constituents are not named—are tabulated. The weight of roots and of the above ground portions of the plants were determined on areas of 1 square meter. The dry matter of the roots contained from 2.24 to 2.57 per cent of nitrogen; the dry matter of the other portions of the plants, from 3.17 to 3.13 per cent.

Potatoes, G. W. McCLUER (*Illinois Sta. Bul. 40, pp. 119-136*).

Synopsis.—Tests of varieties, seed potatoes from different localities, and seed potatoes from best and poorest plats, and fertilizer experiments. Varieties varied greatly from year to year, both in productiveness and quality. Change of seed exerted no constant influence on the yield. Seed potatoes from plats producing the largest yields in 1893 generally yielded more in 1894 than seed from less productive plats of the same variety. On the station farm commercial fertilizers did not increase the yield. The results of the work of other stations on these questions and on size of seed pieces, relative value for seed purposes of different parts of the tuber, time and depth of planting, distance between plants, and depth of cultivation are discussed.

In 1892 Early White Prize afforded the largest yield among 48 varieties tested, in 1893 Grange was the most productive of 110 varieties, and in 1894 the largest yield among 108 varieties was afforded by Burbank. "The potato seems to be so variable and so sensitive to the conditions under which it is grown that about the only recommendation which it is safe to make would be to adhere to the standard varieties, at least for the main crop."

A comparison of seed potatoes from different seedsmen with home-grown seed showed no marked and constant difference in yield. "Changing seed from one locality to another is of doubtful value." With 12 out of 15 varieties, seed potatoes from the most productive plats of 1893 yielded in 1894 more than seed from the less productive duplicate plats.

In experiments at the station extending over 2 years the yield was not notably increased by commercial fertilizers.

The author summarizes as follows the results obtained by other stations in planting seed pieces of different sizes.

"Good-sized whole potatoes have yielded nearly twice as much as potatoes cut to one eye, and there has been nearly a uniform gradation in the crop as the size of seed passed from good-sized whole potatoes through halves, quarters, 3-eye pieces, 2-eye pieces, to 1-eye pieces, and the result has fallen still lower when peelings have been planted for comparison. . . .

"It makes no difference what part of the potato is used for seed. . . .

"There seems no reason to doubt, however, that with rare exceptions the earlier the planting is done the better will be the crop."

As to depth of planting, the results of tests at 5 stations, though somewhat contradictory, are regarded as favoring comparatively shallow planting. "Hills have seldom given as good yields as drills."

"Results [as to depth of cultivating] are so conflicting that no conclusions can as yet be drawn."

Field experiments with potatoes, cabbages, wheat, and oats, B. DYER and E. ROSLING (*Rpt. Field Expts. 1893-'94, Essex Agl. Soc., pp. 14*).—Variety tests of wheat and oats and fertilizer experiments with potatoes and cabbages are reported. On cabbages it was found profitable to apply commercial fertilizers in addition to 14 tons of manure per acre. It is stated that common salt, in combination with stable manure, supplemented by phosphatic and nitrogenous commercial fertilizers, afforded a larger crop than the same weight of muriate of potash in a similar mixture. On this soil potash failed to produce any very marked increase in yield. The soil of the experiment field contained 0.39 per cent of total potash and 0.014 per cent of potash soluble in a 1 per cent solution of citric acid. The total phosphoric acid was 0.13 per cent; that soluble in the above-mentioned solution, 0.02 per cent.

Root crops (*Wyoming Sta. Bul. 22, pp. 51-60, pl. 1*).—Twelve varieties of turnips were grown at the Laramie Station in rows 30 in. apart, and the average yield when the seed was drilled was 60,578.8 lbs. per acre, and only 28,429 lbs. when the seed was sown broadcast on strips about a foot wide. The Early White Egg afforded the largest yield, 41.4 tons per acre. Of 4 varieties of parsnips tested, the Guernsey or Hollow Crown afforded the largest yield, 8,234 lbs. per acre; the varieties with short roots are recommended. Of 7 varieties of carrots the largest yield, 17,807 lbs. per acre, was made by Yellow Belgian. Eleven varieties of garden beets and 5 of sugar beets were tested. The largest yield, 56,784 lbs. per acre, was made by the New Danish sugar beet. Vilmorin Improved contained the highest percentage of sugar, 21.60. The yield of common salsify was at the rate of 10,342 lbs. per acre; of the Sandwich Island variety, 13,794 lbs.

Where Jerusalem artichokes were planted in 1891 the ground contained many tubers in the spring of 1895.

Culture experiments with rye, P. NIELSEN (*Tidsskr. Landbr. Plantearl., I, pp. 1-130*).—This is a report of experiments conducted with different kinds of rye since 1880 at 3 Danish stations for plant culture.

Besides variety tests made every year, with 32 varieties of rye in all, a number of problems of more general interest have been studied.

Comparison of 1-year-old and new seed.—In 5 years' experiments with sowing 161.8 lbs. per acre of each of the 6 kinds of rye experimented with, 654.4 lbs. less straw and 195.8 less grain were obtained per acre, on the average, from 1 year-old seed than from new seed. The old seed seemed to produce a somewhat smaller proportion of straw. The average yields for 6 kinds of rye were as follows:

Average yields of rye from old and new seed

	Yield per acre		Per cent grain
	Straw	Grain	
	Pounds	*Pounds*	
One year old seed	3,906.7	2,366.3	37.8
New seed	4,561.1	2,562.1	36.0
Difference in favor of new seed	654.4	195.8	1.8

Change of seed.—Trials were conducted for 3 years by the author to investigate the question of change of seed. Four varieties of rye were sown; in case of varieties the home-grown seed gave on the average the higher yields, while the opposite was true with 1 variety. The average yields obtained were as shown below:

Average yields of rye per acre from imported and home-grown seed

	Number of trials	Straw	Grain
		Pounds	*Pounds*
Imported seed	43	5,373.4	2,533.0
Home grown seed	137	5,451.8	2,577.5
Difference in favor of home grown seed ...		78.4	44.5

There was therefore no appreciable difference in the average yields of the home grown and imported seed of the same kinds, as far as the data obtained with the 4 varieties under trial show.

The influence of continued hybridization between different varieties of rye.—An increased yield of 416 lbs. of straw and 246 lbs. of grain per acre was obtained from sowing 6 common varieties of rye which had been strongly exposed to hybridization with other varieties, as compared with the yields of check plats of the same varieties. The increased yield of rye exposed up to the fourth and fifth generation, as compared with the yields from rye which had only been exposed in first and second generation, was 436 lbs. of straw and 233 lbs. of grain per acre. Crossing of different varieties of rye therefore seemed to make them more productive, while neither quality nor size of the kernels was perceptibly influenced thereby. The results of these trials are not, however, considered conclusive.

Ten years' trials with different sized seed.—The same weight of large and small kernels, in quantities of 181.2 to 207.1 lbs. of rye per acre,

was sown. Excepting one year (1881) no marked increase in the yield of grain was obtained by the use of large kernels for seed, although the use of large seeds was often followed by an increase of 162 to 324 lbs. of straw per acre. The data given in the following table show the average yields of 2 series of experiments with 7 parallel trials with 4 different sizes of seed:

Average yield of rye from different sized seed (1882).

Size of seed.	Yield per acre. Straw	Yield per acre. Grain	Weight per 1,000 grains.
	Pounds	*Pounds*	*Grams.*
Largest seed	5,771	2,271	37.52
Next to largest seed	5,815	2,310	32.66
Next to smallest seed	5,727	2,347	28.24
Smallest seed	5,697	2,311	22.96

The same number of large and small kernels, viz, from 2.06 to 2.65 million kernels per acre (averages 2.255 million kernels), were sown. The experiments were conducted during four years (1888–'91) with 4 different sizes of Schlanstedt rye, and with 2 sizes of 4 different varieties during 1891–'93. The following table shows the results obtained in the former series of experiments:

Average results with Schlanstedt rye grains of different sizes (1888–'91).

Size of seed	Seed per acre. Amount	Seed per acre. Number of kernels	Weight of seed per 1,000 kernels	Yield per acre. Straw	Yield per acre. Grain	Per cent grain	Weight of 1,000 kernels harvested
	Bushels.	*Million*	*Grams*	*Pounds*	*Pounds*		*Grams*
Largest seed	3.26	2.255	37.3	3,286	1,592	32.4	26.4
Next to largest seed	2.61	2.255	29.4	3,350	1,610	31.6	24.9
Next to smallest seed	2.13	2.255	23.7	3,293	1,547	31.4	25.3
Smallest seed	1.63	2.255	17.3	3,016	1,538	33.0	25.4

Similar results were obtained in the experiments of 1891–'93. In spite of the great difference in the size of the seed the increase in the yield from the largest seed was only slight, amounting in the experiments of 1891–'93 to only 303 lbs. of straw and 56 lbs. of grain per acre.

Experiments with thick and thin seeding.—Four degrees of thickness of sowing, 3.26, 2.90, 2.53, and 2.17 bu. per acre, were tried during 1888–'91, with the following average results:

Thickness of sowing and average yields per acre for 3 years.

Seed per acre. Amount.	Seed per acre. Number of kernels	Weight of seed per 1,000 kernels	Yield per acre. Straw and chaff	Yield per acre. Grain	Per cent grain	Weight of 1,000 kernels harvested.
Bushels.	*Million.*	*Grams*	*Pounds.*	*Pounds*		*Grams.*
3.26	2.932	27.9	3,734	1,570	29.1	24.3
2.90	2.606	27.9	3,752	1,639	30.1	24.4
2.53	2.280	27.9	3,912	1,812	31.3	25.8
2.17	1.954	27.9	3,314	1,584	31.8	28.4

The largest yields of grain and straw were thus obtained by sowing 2.53 bu. of rye per acre.—F. W. WOLL.

Experiments in the culture of sugar beets, E. FREDRIKSSON (*Ugeskr. Landm., 40 (1895), pp. 119–121*).—Experiments with fertilizers and on distance of planting, made by the Association of Danish Sugar Manufacturers during 1889–'90, are reported. The average yields of 3 varieties of sugar beets planted in rows 14 and 18 in. apart were as follows:

Yields of sugar beets at different distances.

	18 inches.	14 inches.	Increase with 14 inches.
	Pounds.	*Pounds.*	*Pounds.*
For 17 experimental farms, 39 trials	30,764	32,910	2,270
For 7 best farms, 21 trials	32,460	35,895	3,435

—F. W. WOLL.

Sulla, L. GRANDEAU (*Jour. Agr. Prat., 59 (1895), Nos. 23, pp. 812–814; 24, pp. 850–851*).—J. Knill tested many species of leguminous plants in the dry climate of Algeria on soil not irrigated. Sulla (*Hedysarum coronarium*) was the most satisfactory plant grown, and proved valuable both for feeding and for green manuring. Three kinds of sulla are mentioned—a native Algerian variety which is biennial, a variety with red flowers, and a perennial variety bearing white flowers. The last mentioned is a dwarf variety, regarded as suitable for permanent meadows on thin, poor, dry soils, and is reported as succeeding even on pure schists.

The author investigated the second variety mentioned above.

The seed of sulla usually germinate with difficulty, but when treated with boiling water for 5 minutes about 95 per cent of the seed germinated. On the assumption that only 50 per cent of the seed would grow, the amount of seed used was 100 lbs. per acre.

The stocky plants of sulla attained a height of 36 to 50 in., and the taproot a length of 20 to 28 in. The yield of seed was about 480 lbs per acre.

On good soil the yield of fresh material was 52,128 lbs.; of hay, 10,285 lbs., and of fresh roots, 11,687 lbs. per acre. Cattle, sheep, hogs, and horses are said to relish the plant, and it is considered valuable as a bee plant.

A sample of leaves and stems analyzed by the author had the following composition:

Analysis of leaves and stems of sulla.

	Fresh.	Dry.
	Per cent.	*Per cent.*
Water	85.00	15.87
Ash	1.97	13.16
Protein	2.38	15.87
Fiber	4.63	30.85
Nitrogen free extract	5.75	38.32
Fat	0.27	1.80

The percentage of phosphoric acid in the fresh stems and leaves was 0.117, or less than that contained in alfalfa. Potash constituted 0.1155 per cent. From this analysis the author regards sulla as of about the same nutritive value as red clover or alfalfa.

The roots had the following composition:

Analysis of roots of sulla.

	Fresh	Water-free.
	Per cent	*Per cent.*
Water	78 500	....
Organic matter	19 490	90 64
Nitrogen	0 221	1.03
Total ash	2 010	9.36
Phosphoric acid	0 060	0 28
Potash	0.099	0 46
Lime	0 322	1 50
Magnesia	0 112	0 52

The author estimates the quantities per acre of fertilizing ingredients in the leaves, stems, and roots as follows:

Amounts per acre of fertilizing ingredients in sulla.

	Nitrogen.	Phosphoric acid.	Potash
	Pounds.	*Pounds*	*Pounds*
In leaves and stems	198	60	61
In roots	26	7	11
Total	224	67	72

The author states that sulla makes less demand on the soil for potash than most other leguminous plants. The immense quantity of nitrogen contained in the crop, which this leguminous plant is presumed to obtain largely from the atmosphere, recommends sulla as a crop for green manuring on land not irrigated in semiarid regions.

Final report on tobacco grown in 1893 with different fertilizers, E. H. JENKINS (*Connecticut State Sta. Rpt. 1894, pp. 254–270*).

Synopsis.—The results of an examination of the fermented leaves grown in 1893. The report of an expert relating to the quality of the different lots is given; also tabulated data on the fire-holding capacity of the different lots and a discussion of the effect of fertilizers on the quality and quantity of tobacco. The several lots did not differ greatly in quality, an unfavorable season producing a poor quality in all the samples.

This is a continuation of the work on tobacco reported in the Annual Report of the station for 1893 (E. S. R., 5, p. 865).

"It is questionable whether any fair conclusions can be drawn as to the effects of different fertilizers on the quality of the tobacco when it seems probable that the drought rather than the fertilizers controlled the quality of the crop.

"It is a striking fact that the fermented tobacco of 1893 crop from almost all the plats had a fair to very good burning quality. . . .

"The defects of the experimental crop of 1893, common to the tobacco of nearly all the plats, and therefore attributed to conditions of weather, are wholly in the 'texture' and 'colors.'"

In addition to the expert's test the fire-holding capacity of each lot was tested in the station laboratory and the results tabulated.

"The fire-holding capacity of all the lots was increased by fermentation, though not by any means equally in all cases.

"The average fire-holding capacity before fermentation was 9 seconds; after fermentation, 18 seconds. . . .

"A more accurate method of determining fire-holding capacity is desirable. . . .

"There is substantial agreement between the judgment of the expert on the fire-holding capacity of the different lots and the results of the laboratory tests on this point. . . .

"Tendency to 'coal' when wrapped on a cigar is not apparently associated with deficiency in fire-holding capacity."

The yield of fermented wrappers averaged 778 lbs. with castor pomace and 682 lbs. with cotton-seed meal containing equal amounts of nitrogen. When linseed meal was used the yield of wrappers was greater and the quality of the product better than with cotton seed meal or castor pomace containing corresponding quantities of nitrogen.

"The heaviest applications, 3,000 lbs. of cotton-seed meal and 1,520 lbs. of castor pomace per acre, gave the best quality of leaf as well as the largest yield."

Tables and notes give meteorological conditions and soil temperatures. On 3 plats differently fertilized the average water content of the soil was practically identical.

Experiments in growing tobacco with different fertilizers in 1894, E. H. JENKINS (*Connecticut State Sta. Rpt. 1894, pp. 270–281*).

Synopsis.—Castor pomace, cotton-seed meal, linseed meal, tobacco stems, nitrate of soda, dry fish, cotton-hull ashes, double sulphate of potash and magnesia, carbonate of potash, high-grade sulphate of potash, double carbonate of potash and magnesia, wood ashes, and several brands of fertilizers were tested in various combinations. Castor pomace and cotton-seed meal afforded practically the same yield. Of the potash salts double sulphate of potash and magnesia gave the best results.

This is a continuation of an experiment reported in the Annual Report of the station for 1893 (E. S. R., 5, p. 865). The yields of unfermented tobacco are tabulated and briefly discussed, a full discussion being postponed until after 5 successive crops shall have been raised, cured, and fermented.

The maximum yield, 2,115 lbs. of sorted tobacco, was obtained by the use of a mixture of 2,200 lbs. of Mapes's Tobacco Manure and 600 lbs. of Mapes's Starter per acre. The maximum yield of wrappers, 1,330 lbs., was obtained by using either 2,720 lbs. cotton-seed meal and 1,444 lbs. cotton-hull ashes or 3,780 lbs. of castor pomace and 1,520 lbs. of cotton-hull ashes per acre; the yield of sorted tobacco on these plats was 1,860 lbs.

"Increasing the quantity of cotton-seed meal in the fertilizer from 1,360 to 2,260 lbs. per acre did not increase the yield, but a further increase of 500 lbs. per acre made an increase of 250 lbs per acre in the sorted tobacco. The quantity of wrappers increased regularly with the increase in the quantity of cotton seed meal or castor pomace applied."

When the nitrogen was supplied only in the form of castor pomace the yield of wrappers was greater than when a part of the nitrogen was applied in the form of nitrate of soda.

In 1894, as in previous years, the double sulphate of potash maintained its superiority to the other potash salts, affording the largest yield of sorted tobacco and of wrappers.

"Plat AA, which was dressed with stable manure, and BB, which was dressed with tobacco stems and castor pomace, produced less tobacco than most of the other plats and the least wrappers of any plats."

Field experiments at Ghent, Belgium, P. DE CALUWE (*Exposé Cult. Expér. Jard. Gand, 1893–'94, pp. 97*).—Among these were variety and fertilizer tests with rye, barley, flax, sugar beets, chicory, turnips, and potatoes; variety tests of oats, wheat, peas, and lupines, and a fertilizer test on prickly comfrey.

Very large, large, ordinary, small, and very small grains of oats were sown, all at the rate of 111 lbs. per acre. The yields of grain were slightly in favor of small and ordinary seed; the result was attributed to the greater number of grains sown per plat with the smaller classes of seed. The author considers it advisable to employ a greater weight of large than of small seed. In a test of cut potatoes and whole potatoes of different sizes the largest yield, after deducting the seed potatoes planted, was afforded by large whole tubers, and the next largest yield by medium-sized whole potatoes.

The alleged deterioration of English malting barleys, E. R. MORITZ (*Abs. in Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 373–390*).—This deals chiefly with the process of malting.

Carrots vs. mangel-wurzels, L. HELWEG (*Ugeskr. Landm., 40 (1895), pp. 131–134*).—Comparison of yields and nutritive value of the two crops. The author finds that mangel-wurzels as a rule will yield about 1,600 lbs. more dry matter per acre than carrots, and that wherever the former will grow well it will not be profitable to grow carrots.

Duthiea, a new genus of grass, E. HACKEL (*Verhandl. k. k. Zool.-bot. Ges. Wien, 45 (1895), No. 5, pp. 200–203*).—A description is given of *Duthiea bromoides*, a new Indian grass.

Grasses and forage plants of foreign countries, F. H. MASON, A. B. MORSE, G. GADE, et al. (*U. S. Consular Rpt. 1895, June, pp. 227–250*).—The grasses and forage plants most extensively grown in Germany, Scotland, and Norway are discussed at some length, and shorter lists of those that are important in some other countries are given.

Forage plants (*Wyoming Sta. Bul. 22, pp. 60–63*).—This is a record of tests on the Laramie plains and at Wheatland of alfalfa, common millet, rape, Kaffir corn, Jerusalem corn, millo maize, brown durra, timothy, and awnless brome grass.

Leguminous fodder plants, R. S. MACDOUGALL (*Abs. in Agl. Jour. Cape Colony, 8 (1895), Nos. 13, pp. 319, 320; 14, pp. 348, 349, figs. 2*).—The poisonous effects of *Lathyrus sativus* seed and of other leguminous plants are discussed, and a partial bibliography of the subject is given.

Pastel or woad as a forage plant on calcareous soil, E. SCHRIBAUX (*Jour. Agr. Prat., 59 (1895), Nos. 23, pp. 820–822; 24, pp. 854, 855*).—The plant is regarded by the author as of about the same value as white mustard.

Pastel or woad as a forage plant, J. BRUNET and G. ALLUARD (*Jour. Agr. Prat., 59 (1895), No. 26, pp. 925–928*).

On the fertilizer constituents in oats as indications of the manurial requirements of the plants, A. ATTERBERG (*Abs. in Centbl. agr. Chem., 24 (1895), No. 4, pp. 259–262*).

Lupines as green manuring plants in Norway, B. LARSEN (*Tidskr. norske Landbr., 1894, pp. 39–44; abs. in Centbl. agr. Chem., 24 (1895), No. 2, p. 133*).—In experiments in the southern part of Norway yellow lupine did not afford a satisfactory yield. Of the 3 sorts of lupines tested the narrow-leaved blue lupine was most productive. Thomas slag and kainit but slightly increased the yield. The plats inoculated with soil from an old lupine field produced about 8 per cent more than plats not inoculated.

Potatoes (*Wyoming Sta. Bul. 22, pp. 17–51*).—This is a report on progress and gives results of experiments to determine the best size of seed pieces, and of variety tests made in 3 localities in the State. Full details as to size of seed pieces are not given. The profit in growing an acre of potatoes at Laramie was \$64.60, at Lander \$54.38, and at Wheatland \$59.80.

Important points in potato culture, J. PEDERSEN (*Bjergaard Lanumansblade, 28 (1895), pp. 255–260*).

Fertilizer experiments with potatoes (*Deut. landw. Presse, 22 (1885), No. 49, pp. 455, 456*).

Chemical composition and relative value of Norwegian root crops, F. H. WERENSKIOLD (*Norsk Landmansblad, 14 (1895), pp. 151, 152*).

The culture of hairy vetch, SOBOTJA (*Abs. in Centbl. agr. Chem., 24 (1895), No. 3, pp. 181–183*).—A popular article.

Cost of growing certain farm crops, J. W. ROBERTSON (*Canada Exptl. Farms Rpt. 1894, pp. 93–101*).—Statements showing the cost of growing crops of small grain, roots, corn, and sunflowers. The yield of nearly ripe heads was 3 tons per acre.

Drill sowing, S. FORSBERG (*Tidskr. Landtmän, 16 (1895), pp. 248–254*).

Cereals and other field crops (*Wyoming Sta. Bul. 22, pp. 63–73*).—Notes on the yield of 15 varieties of wheat, 14 of oats, 10 of barley, 2 of rye, 6 of corn, 4 of broom corn, and 2 of peas, the tests in most cases being made at more than one of the substations. New Russian flax produced 15.6 bu. of seed per acre. At Wheatland the yield per acre of White Russian wheat on an unfertilized plat was 20 bu., on a plat receiving a heavy application of stable manure 40 bu., on a plat where a crop of field peas had been turned under while in bloom 23 bu., and on a plat where a crop of red clover had been plowed under when mature 30 bu. At Lander the results of a similar experiment were less decisive.

Rotation of crops, J. J. WILLIS (*Gard. Chron., 18 (1895), No. 446, pp. 38, 39*).—A continuation of a series of papers on this subject. The present paper deals with the plant food taken up by various crops.

Agrostology in the Department of Agriculture, F. LAMSON-SCRIBNER (*Science, 2 (1895), No. 32, pp. 151, 152*).—A brief statement is given of the organization of this division and the work outlined for the future.

HORTICULTURE.

The dwarf Lima beans, L. H. BAILEY (*New York Cornell Sta. Bul. 87, pp. 83–101, figs. 11*).

Synopsis.—Seven distinct forms are recognized and illustrated: Sieva, Henderson, Jackson, Thorburn, Dreer, Burpee, and Barteldes. They belong to 2 species, *Phaseolus lunatus* and *P. multiflorus*. Of the latter Barteldes is the only representative and is of little value. Of the offspring of the former the Sieva dwarfs are earliest and most productive; the potato Lima dwarfs (Thorburn or Dreer) are of the highest quality; the large Lima dwarf, the Burpee, has given as good results as the earlier or small-seeded varieties.

This bulletin deals with the history and evolution as well as the botanical and horticultural characteristics and relationships of the

dwarf Lima beans, of which 7 distinct forms are recognized and illustrated. It is stated that the original of the first variety, the Henderson, was found growing wild along the roadside in Virginia some 20 years ago. The Kumerle or Thorburn dwarf Lima originated from dwarf forms of the Challenger pole Limas. The Burpee originated in 1883 from a plant of the Large White Lima which had been cut down by cutworms, but which matured 3 beans. From these 2 dwarf plants were grown. The Barteldes bush Lima is a sport of the White Spanish or Dutch Runner bean, and originated in Colorado.

The several varieties are arranged and classified according to the species from which they originated, and detailed illustrated descriptions are given of each of the varieties, which are as follows: Sieva, Henderson, Jackson, Thorburn, Dreer, Burpee, and Barteldes. They vary in habit and hardiness and in the size and appearance of the beans, some of them being less than half the size of the others and some of them pure white, while others are speckled with brown. The Barteldes bush Lima differs in its germination from that usually found among beans, the cotyledons remaining below ground when the seed sprouts. This variety frequently has a fleshy tap root, showing a strong tendency toward becoming a perennial. It is believed by the writer that the dwarf Limas are of considerable economical value on account of their earliness, as they mature their pods from 2 weeks to a month earlier than the pole varieties. The following summary is given:

"The dwarf or bush forms of the Lima beans are, as a class, acquisitions to the vegetable garden. They belong to 2 distinct species, *Phaseolus lunatus* and *P. multiflorus*. The single variety derived from the latter species—the Barteldes—seems to have little to recommend it for cultivation in New York. The dwarf offspring of *Phaseolus lunatus* are of 3 general types: (1) The Sieva dwarfs, which are the earliest and most productive and of which the most serviceable variety appears to be the Henderson; (2) the potato Lima dwarfs, represented by the Thorburn or Dreer, which are of the highest quality and in all ways desirable; (3) the large Lima dwarf, the Burpee, which has been the leading single variety upon our own grounds on account of the large size and high quality of its beans, and it is evidently as well adapted to general field culture as the earlier or smaller-seeded varieties. All these dwarf Limas—Henderson, Jackson, Thorburn, and Burpee—are worth growing either for home or market."

Onions, B. C. BUFFUM (*Wyoming Sta. Bul. 22, pp. 31–46, pls. 2*).—This bulletin gives the results of a variety test of onions carried on for 2 years at the station and at each of the substations.

At Laramie 21 varieties were tested, the seed of each being started in hotbeds and afterwards transplanted to the field and also sown in the open field. The former method gave larger yields and better onions. For field culture Large Red Wethersfield, Southport White Globe, and Southport Yellow Globe are recommended. The Italian varieties, such as Barletta, Maggiajola, Giant White Etna, etc., were the best early onions, but were not good keepers.

At Sheridan, El Paso, Red Bermuda, Extra Early White Queen, and Extra Early Barletta proved the earliest varieties. Oregon Long Keeper, various forms of Danvers, Red Victoria, Red Globe, Prize-

taker, and Red Wethersfield are recommended for growing in the northern part of the State.

Only inconclusive notes were furnished from Sundance, but heavy crops were obtained at Wheatland, White Bermuda yielding over 46 tons per acre. White Globe, Danvers, White Bermuda, Large Red Wethersfield, and Red Globe are especially recommended.

Elaborate data are given showing the comparative yield, weight, per cent marketable, etc.

Notes on vegetables, C. W. MATHEWS and A. T. JORDAN (*Kentucky Sta. Bul. 54, pp. 36*).—This comprises notes and investigations on tomatoes, peas, beans, and potatoes.

Tomatoes (pp. 4–18).—Tabulated data are given for tests of 51 varieties, of which several are believed to be synonyms. Essex Hybrid, Gold Ball, and Michigan were the first to ripen fruit, commencing on June 25. The most productive varieties up to the time of killing frost were Table Queen, producing 108 lbs. 10 oz. from 10 plants; Early Ruby, 107 lbs. 11 oz.; Conqueror, 102 lbs. 5 oz., and Crimson Cushion, 101 lbs. 5 oz., followed closely by Cardinal, Trophy, and Ten Ton. The variety producing the largest fruit (averaging 6.75 oz.) was the Ring leader, and the smallest proportion of rot was found in Gold Ball, a small yellow variety, in which less than 1 per cent was affected by rot, followed by Dwarf Aristocrat, in which 1 fruit rotted out of every 17. Descriptive notes are given for 19 varieties.

An experiment undertaken to ascertain whether the best results would be obtained by growing the plants in shallow boxes or in pots gave results in favor of pot growing, Perfection grown in pots producing 23 oz. more fruit per plant than when grown in boxes, while in Livingston Favorite the gain was 15 oz. per potted plant.

To determine the most favorable time for starting tomatoes seed of Livingston Favorite was sown in boxes on February 7, and 7 successive sowings were made at 10-day intervals. The plants were transplanted to the field at 3 different dates in May and June, but the experiment was interfered with by drought and was inconclusive. It appeared, however, that no advantage was gained by sowing seed before the 1st of March.

In a comparison of stocky and slender plants a decided gain in size of fruit and in productiveness was made by the former, the yield averaging 1 lb. 5 oz. more per plant than that produced by the latter.

Cutting back plants at the time of setting was done with Livingston Favorite, Acme, and Buckeye State, but it produced no effect on the productiveness, although the untrimmed plants were from 3 to 15 days earlier than the trimmed ones of the same variety.

The results of experiments with Bordeaux mixture for the prevention of rot were conflicting and inconclusive.

Peas (pp. 18–25).—Thirty-seven varieties were used in a comparative test, and tabulated data are given showing the nature of each variety,

its date of maturity, yield, quality, etc. Descriptive notes are given for 16 varieties. An experiment made to determine the proper thickness of planting showed that the best average results were obtained by a quart of seed to every 80 or 90 ft. of drill.

Bush beans (pp. 25-30).—Tabulated data and descriptive notes are given for 25 varieties, of which the earliest was Wakefield and the most productive were Improved Valentine, Speckled Wax, and Extra Early Refugee.

In an experiment with thick and thin planting Improved Valentine and Golden Eye Wax were planted in 12 degrees of thickness (½ oz. to 6 oz. of seed) in 12-foot rows. One and one-half ounces of seed to 12 ft. gave the largest yield, 140 oz., with both varieties, but it is believed that in order to provide against some of the seeds not germinating it is better as a rule to use a larger proportion of seed.

Bush Lima beans (pp. 28-30).—Tabulated data for tests of 5 varieties, in which Henderson and Jackson Wonder gave the best results.

Pole beans (pp. 30-34).—Tabulated data on 12 varieties of common and 9 varieties of Lima beans. Of the first, Kentucky Wonder and Yard Long were the most productive, while of the Limas, Large White, Ford Mammoth, and Large Select gave the largest yield.

Potatoes (pp. 34-36).—Tabulated data are given for 64 varieties, the yield of which was interfered with by the severe drought, which not only decreased the yield but also resulted in small tubers being produced.

Vegetables, F. W. RANE (*West Virginia Sta. Bul. 39, pp. 137-156, figs. 8*).—This consists of cultural notes and tabulated data on the testing of 23 varieties of bush beans, 8 of dwarf Limas, 4 of pole Limas, 7 of pole beans, 19 of beets, 12 of cauliflower, 22 of first early cabbage, 18 of second early, and 23 of late, 21 of celery, 21 of cucumbers, 8 of eggplant, 5 of kale, 3 of kohl-rabi, 49 of lettuce, 29 of muskmelon, 35 of onions, 31 of peas, 9 of peppers, 23 of radishes, 4 of salsify, 10 of summer squash, 20 of sweet corn, 56 of tomatoes, and 15 of watermelons. Numerous other vegetables were also grown, but are not commented on in detail.

A few varieties of some of the vegetables are especially recommended as follows: *Cauliflower*—Early Dwarf Erfurt, Alabaster, Early Snowball, Model, and Early Perfection; *second early cabbage*—All Seasons, Succession, Early Dwarf Flat Dutch, and Bloomsdale Early Market; *late cabbage*—Early Deep Head, Christmas King, Danish Round Winter, Sure Head, and Autumn King; *celery*—Golden Self-Blanching; *cucumbers*—White Wonder, White Spine, Meaux Green Pickling, Long Green, and Early Cluster; *eggplant*—New York Improved Large Purple and Black Pekin; *lettuce*—Grand Rapids, Black-Seeded Simpson, Hanson, Boston Curled, Frankfort Head, Always Ready, and Wheeler Tom Thumb; *muskmelons*—Extra Early White, Banquet, Extra Early, Irondequoit, Jenny Lind, New Tip Top, Extra Early Hackensack, Jer-

sey Belle, and Miller Cream; *onions*—Prizetaker and Early Red Globe. A number of the varieties are illustrated from photographs showing them side by side, thus indicating their comparative value. It was found that by starting the plants in the greenhouse large crops could be grown on high land in a dry season where the old method would fail.

A list of the donations of seed made to the station during the year is given.

Notes on experiments with the pineapple, L. C. WASHBURN (*Florida Sta. Bul. 27, pp. 69-76, pl. 1*).—This bulletin gives the results of some experiments in the culture of pineapples at the Fort Myers Substation, the effect of different fertilizers being especially studied. The soil on which the pineapples were planted was the common pine and saw palmetto land, possessing a large proportion of silica and humus, with a stiff subsoil from 1 to 2 ft. below the surface. It was found that if the usual custom was followed of pulling off suckers and slips the plants did not grow so rapidly or strongly as those in which the lower leaves were bent down to the ground and covered with an inch or two of soil. The leaves so treated steady the young plants, and the earth which covers them is an advantage to the lateral roots coming out from the lower part of the plant stem.

The plants in different plats were set at different distances apart, with the result that plants set 18 by 18 in. grew best, were easily cultivated, supported and shaded each other, and yielded large crops. Clean, shallow cultivation with a scuffle hoe is advised.

Experiments in fertilizing the different plats of pineapples with cotton-seed meal, muck, and a compost of combined fertilizers produced results strongly in favor of the compost. It is recommended that complete fertilizers be used consisting of barnyard and poultry manure, muck, and commercial fertilizers combined. Plants that were mulched grew rapidly, but proved very tender and more liable to injury from light frosts than plants not so treated.

The varieties tested were Smooth Cayenne, Prickly Cayenne, Jamaica Queen, Red Spanish, and Sugar Loaf. They are all recommended as regards flavor, but the Sugar Loaf is rather too tender for commercial purposes.

Fruits at South Haven, T. T. LYON (*Michigan Sta. Bul. 118, pp. 64*).—This bulletin contains accounts of variety tests of various orchard and small fruits and of a few nuts and vegetables, tabulated data in regard to the flowering and fruiting seasons, yield, and quality being given for all the varieties grown. In addition, comparative descriptive notes are given for many of them. Data are given for 146 varieties of strawberries; 62 of raspberries, comprising 5 species; 31 of blackberries; 3 of service berries; 23 of currants, comprising 3 species; 20 of gooseberries, comprising 3 species; 68 of cherries, comprising 2 species; 5 of blueberries, comprising 2 species; 195 of peaches; 1 of apricot; 2 of nectarines; 145 of grapes; 102 of plums; 23 of pears; 65

of apples; 5 of quinces; 2 of almonds; 6 of chestnuts; 2 of English walnuts; 2 of pecans; 1 each of Japan walnut, chinkapin, filbert, hazelnut, and fig; and several varieties of asparagus and rhubarb.

The pear or cherry slug (*Eriocampa cerasi*) appeared upon cherries, plums, pears, and quinces, but was checked by the application of tobacco water.

Small fruits at Laramie (*Wyoming Sta. Bul. 22, pp. 80, 81, pl. 1*).—Brief notes on the condition of small fruits at the Laramie Experiment Farm. The fact that the farm is on the prairie exposed to high winds greatly interfered with many of the fruits. The strawberries, raspberries, and grapes, and most of the gooseberries have died during the dry winters, but the currants have done well without protection and are bearing, the variety Red Cherry producing the largest yield, followed by White Grape and Fay Prolific. The Japanese wineberry and juneberry have lived without winter protection.

The China asters, L. H. BAILEY (*New York Cornell Sta. Bul. 90, pp. 143–162, figs. 11*).—This bulletin, in addition to an illustrated description of the various types of China asters, is prefaced by some remarks upon flower beds in which the writer urges the lavish planting of flowering plants, both annual and perennial, setting the beds as borders along walks, fences, and lawns instead of constructing them as geometrical figures in the midst of greensward. The more extensive use of native wild perennials of various kinds is recommended.

It is stated that the China asters, natives of China, were introduced into Europe as single-flowered blossoms in the first half of the last century, and that these early varieties were blue, violet, or white. Since that time the improvement and variation of the China asters have been very great. They naturally possess colors of the cyanic series and are slow to acquire xanthic colors, but 2 recent varieties have been introduced in which the blossoms are suffused with yellow. The form of the flower head has been developed in several directions, first in the line of "quilled" flowers with the central florets much prolonged, and afterwards the fluffy, flat-rayed type resembling the uncombed chrysanthemums. The Comet type, possessing flat, soft, spreading, long rays, is preferred by the writer, with the peony-flowered Truffaut asters following, and the Chrysanthemum flowered types ranking third.

The China asters are difficult of satisfactory classification, but the following divisions are suggested: (1) Flat-rayed asters, comprising incurved, ball-shaped, or globe asters, represented by Truffaut, Semple, Triumph, etc., and the spreading or reflexed asters, represented by the Chrysanthemum-flowered, Washington, Victoria, Comet, etc., and (2) the tubular or quilled asters, comprising the Button-quilled asters with the inner florets short, represented by the German Quilled, Dwarf Bouquet, and Shakespeare, and the long-quilled or needle asters with all the florets elongated and quilled, represented by the Victoria Needle and Lilliput.

A list of 229 names of varieties of China asters offered by dealers in the spring of 1895 is given. Brief notes are given on the cultivation, early flowers to be produced by starting the seeds in frames in early spring. Spraying with ammoniacal carbonate of copper is recommended if the rust (*Coleosporium sonchiarvensis*) appears. The accompanying summary is given:

"This bulletin desires to discourage the formal and geometrical flower bed, which persists in setting itself into the middle of a quiet and well-behaved lawn. It advises that flowers be grown for their own sakes, and not for the bed in which they happen to be placed. It urges the growing of flowers profusely, in a free and graceful way, in borders next rear walks and fences and against groups of larger plants and occasionally about the foundations of buildings. It would use hardy and free-growing plants in preference to the potted and unwilling house plants, which usually give strained and exotic effects

"The China asters are among the best of the annuals for po ular use. They are essentially autumn flowers, and little is to be gained by forcing them ahead of their season, except when they are wanted for sale as cut flowers. In central New York they may be sown as late as the first or even the middle of June with good results, if the soil is rich and if they are given good care. There is a multitude of varieties. For growing in borders perhaps the best type is the Comet, in various colors. Other excellent races are the Truffaut, known also as Perfection and Peony-flowered, the Semple or Branching, Chrysanthemum-flowered, Washington, Victoria and Mignon, and Queen of the Market. The last is commended for earliness and graceful open habit, and it is one of the best for cut flowers. Many other types are valuable for special purposes The Crown or Cocardeau is odd and attractive. Among the quilled asters, the various strains of German Quilled, Victoria Needle, and Lilliput are excellent. The very dwarf tufted asters are well represented in Dwarf Bouquet or Dwarf German, and Shakespeare."

Recent chrysanthemums, M. BARKER (*New York Cornell Sta. Bul. 91, pp. 167-191, figs. 6*).—This bulletin treats of investigations carried on with a number of the newer varieties of chrysanthemums, with a view to ascertaining the relative improvement over older varieties. The plants were grown in a long greenhouse bed in a mixture of decomposed clay sod and well-rotted manure 12 in. deep. They were set 10 in. apart the 9th and 10th of August, mulched lightly with barnyard manure 3 weeks later, twice fertilized with commercial fertilizers applied broadcast, and watered with a weak solution of cow manure until the buds began to show color. Each plant was trimmed to a single flower stem. It was found that a number of the recent varieties were superior to older types, although in many varieties there was no marked improvement. The improvement was in the direction of dwarf, stout, well foliaged stems, and large, well-filled blooms. Descriptive notes and the dates of blooming are given for 78 varieties. The following varieties are considered best for commercial purposes: *Yellow*—Eugene Dailledouze and Major Bonnaffron; *white*—Mayflower and Marie Louise; *pink*—Mrs. E. G. Hill and Laredo; and *bronze*—Charles Davis and Ingomar. The large white chrysanthemum, Niveus, is considered as fulfilling the American ideal of perfection.

The various methods of chrysanthemum culture are discussed, pots, benches, and beds being successively considered, and the preference

given to bench culture, where the plants are grown in soil averaging 6 in. in depth, confined at the sides and bottom. Persistent attention must be paid to the watering of the plants to secure the best blooms.

The black aphis, green fly, mites, tarnished plant bugs, and thrips are considered the most injurious insects affecting chrysanthemums, and are to be combated by the use of pyrethrum powder, kerosene emulsion, or tobacco. The frequent premature death of flower buds is believed in the majority of cases to be due to mechanical injury during the operation of removing the buds.

A key to the classification of varieties of chrysanthemums is given, they being divided into 3 groups, each with several sections and subsections.

On the acclimatization and culture of varieties of the ordinary garden bean, T. VON POST (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 52-55*).

The onion and its cultivation, W. W. GLENNY (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 257-275*).

Colored atlas of edible and poisonous mushrooms, M. J. COSTANTIN (*Atlas en couleur des champignons comestibles et veneneux. Paris: Paul Dupont, 1895, pp. 300*) — Colored plates are given of 228 species, together with detailed descriptions of 300 mushrooms.

Contribution to the analyses of mushrooms, GUICHARD (*Bul. Soc Mycol France, 11 (1895), No. 2, pp. 88-94*).—Notes are given of the quantity of water, and dry substance, investigations for mannane, and quantity of spores furnished by mushrooms.

Manures for bananas (*Bul. Bot. Dept. Jamaica, 2 (1895), No. 7, pp. 151, 152*).

Analyses of the orange tree (*Bul Bot. Dept. Jamaica, 2 (1895), No. 6, pp. 119-121*).—Chemical analyses are given of the root, stem, leaves, fruit, and seed.

The new vs. the old varieties of strawberries, O. W. BLACKNALL (*North Carolina State Hort. Soc. Rpt. 1894, pp. 18-20*).—The writer believes that the recent varieties of strawberries far surpass those of a few years ago, and recommends the growing of only those varieties that prove best adapted to the special soil and climate of any given locality. Notes are given on several varieties, especially Wilson, Barton, Crescent, Tennessee Prolific, and Haverland. The Barton is strongly recommended for earliness, productiveness, and size.

The forcing of table grapes (*Bul. Min. Agr. France, 14 (1895), No 4, pp 474-476*).—Report of the Director of the School of Horticulture and Pomology at Florence on the methods of forcing employed in that institution.

Variegation in flowers and fruits, J. D. LATOUCHE (*Nature, 52 (1895), No. 1341, p. 295*).—An account is given of a peculiarly colored apple, half of which was light green, the other side brown, the line of demarcation being very clearly marked.

SEEDS—WEEDS.

The Russian thistle and some plants that are mistaken for it, G. P. CLINTON (*Illinois Sta. Bul. 39, pp. 87-118, figs. 19*).—The author gives a brief account of the life history of this plant. Owing to the innumerable mistakes in calling other plants Russian thistle the author has briefly summarized some of the more prominent characteristics of the Russian thistle by which it may be identified. The suggestions are:

"(1) In the first place the leaves alone are sufficient to distinguish it Instead of having the normally flat blades that most leaves possess, its leaves are nothing more than needle-shaped bodies 1 or 2 in. long by about $\frac{1}{16}$ in. in diameter, and are provided with a small spiny tip. When young the leaves are soft and juicy.

"(2) With older plants the ultimate or flowering branches are provided with shorter, rigid leaves having somewhat expanded bases. Each of these leaves has 2 similar lateral bracts, or leaves, in its axil, so that the 3 short, somewhat triangular bracts serve as a convenient place for the flower, and when the seed is developed it is inclosed rather securely between the bracts and the stem. These bracts are rather numerous on the stem, spreading out at nearly right angles.

"(3) The fruit is peculiar in that at maturity it is still tightly inclosed by the 5 parts of the calyx, each of which is winged on the back with a spreading appendage. The lobes of the calyx also meet in the center above the fruit in a sort of beak.

"(4) The seed is characterized by the embryo, or young plant, which entirely fills it. This embryo, which consists of a slender stem and 2 green linear leaves, is coiled spirally, so that it gives the seed an obconical shape. These parts can be made out by soaking the seed in water, if dry, and then carefully pulling it apart with needles.

"(5) The rose-red streaking of the plants as they approach maturity, although common with other members of this family, is also striking."

Notes are given on the distribution of the weed in this and other countries and a detailed account of its spread in Illinois.

Brief suggestions are offered for the control of the plant, together with illustrated descriptions of some of the plants most commonly mistaken for it. The aim and use of weed laws are briefly stated and the text of a proposed amendment to include the Russian thistle in the weed law of the State is given. A comprehensive bibliography of the literature completes the bulletin.

On the buoyancy of the seed of aquatic and marsh plants, F. KOLPIN RAVN (*Bot. Tidsskr., 19 (1895), No. 3, pp. 178-188, figs. 26*).—A résumé of a preceding paper.

Concerning the relation between the composition of beet seed balls and the sugar content of beets, F. STROHMER, H. BRIEM, and J. NEUDORFER (*Oesterr. ungar. Ztschr. Zuckerind. und Landw., 1894, p. 14; abs. in Centbl. agr. Chem., 24 (1895), No. 2, pp. 101, 102*).—No constant relation was found.

The germination of oil-bearing seed, LECLERC DU SABLON (*Rev. gén. Bot., 7 (1895), Nos. 76, pp. 145-165; 77, pp. 205-215; 78, pp. 258-269*).

Annual reports of the Seed Control Station and the Chemical Station at Jönköping (Sweden) for 1893 and 1894, C. O. VON PORAT and C. VON FEILITZEN (*Jönköping: 1894 and 1895, pp. 80, 84*).

Annual reports of the Seed Control Station in Stockholm, Sweden, for 1893, O. STJERNQUIST (*Stockholm: 1894 and 1895, pp. 11, 7*).

Report of the Seed Control Station at Halmstad, Sweden, for the year 1894, E. LYTTKENS (*Halmstad: 1895, pp. 7*).

The hedge mustard and its destruction (*Oesterr. landw. Wochenbl.; Landw. Centbl. Posen, 23 (1895), No. 23, pp. 133, 134*).

North German weeds, F. HÖCK (*Engler's Bot. Jahrb., 21 (1895), No. 1 and 2, pp. 53-104*).

DISEASES OF PLANTS.

Fungus diseases and their treatment, W. C. STURGIS (*Connecticut State Sta. Rpt. 1894, pp. 113-139, pl. 1*).

Synopsis.—Notes are given on fire blight of pear and apple trees, a fire blight of plum trees, experiments on the prevention of potato scab, scab on turnips, early blight of potatoes, experiments on the treatment of pear scab, and miscellaneous notes on quince rust and scab and mold of peaches.

The author gives a summary of the cause and means of prevention of fire or twig blight of pear and apple trees, recounting the investi-

gations of Burrill, Arthur, and others with *Bacillus amylovorus*. The disease is not yet widely spread throughout Connecticut.

In July, 1894, the author's attention was called to a blight, greatly resembling the fire blight, that had attacked a plum orchard. Microscopic examination revealed the presence of bacteria, and on the leaves was found an undetermined Cladosporium. Attempts to secure pure cultures of the bacteria and all efforts to inoculate apple, pear, and quince trees from the plum virus failed. Specimens were referred to Dr. J. C. Arthur, of the Indiana Station, who reported as follows:

"The appearance of the twigs is certainly that of pear blight, but I have never seen genuine pear blight attacking any of the stone fruits. I do not have any difficulty in finding the bacteria in quantity in the diseased tissues. I should say that the disease is likely to be bacterial in its nature, but not to be identical with pear blight."

The author conducted a series of experiments for the repression of potato scab by means of the corrosive sublimate treatment, the results of which are summed up as follows:

"(1) The character of the seed as regards scab has much to do with the character of the crop. As a rule scabby seed will produce a scabby crop, other things being equal; and the amount of scab on the crop will be directly proportional to the amount of scab on the seed.

"(2) In the presence of barnyard manure the tubers tend to become scabby to a degree not markedly affected by the character of the seed, whether clean or scabby.

"(3) Treating the seed with corrosive sublimate before planting avails to some extent in preventing scab when barnyard manure is used, though the amount of scab present under such circumstances may vary with the character and composition of the manure. Further experiments may compel a modification of this conclusion.

"(4) The use of commercial fertilizer is not a preventive of scab, but when clean seed is planted on clean land the amount of scab is far less with commercial fertilizer than with barnyard manure. The same is true in a lesser degree when scabby seed is used.

"(5) Treating scabby seed with corrosive sublimate before planting tends to decrease the amount of scab upon the tubers even in the presence of barnyard manure.

"(6) The treatment of scabby seed with corrosive sublimate before planting may produce a practically clean crop if commercial fertilizer be used and the land be clean. Clean seed under like conditions will certainly do so."

The author figures and reports upon the occurrence of scab on turnips grown on land which for the 2 years preceding had produced a scabby crop of potatoes. In accordance with his observations, turnips are to be added to the list of crops that can not be used in rotation with potatoes.

Notes are given on the early potato blight in which the author reviews some of the more recent work of the stations in its investigation. He seems to doubt the general statement that the disease is wholly due to *Macrosporium solani*, as that fungus was not present, or only feebly represented in many specimens examined, and much of the injury is to be attributed to physiological action induced by intense heat, drought, and insect injuries. Specimens examined showed that—

"The flea beetle had been abundant, and on some of the specimens there were traces of Macrosporium. These facts seem to add probability to the theory that

extreme heat and dryness, accentuated by lack of moisture in the soil, may induce the death of tissues at a distance from the roots (the tips and edges of leaflets); that this damage may be increased and even initiated by the attacks of predatory insects (flea beetles) which partially destroy the tissues at certain points; and that, finally, in some cases a facultative parasite (a fungus which exists normally as a saprophyte upon dead tissues, but may, under certain conditions, attack living tissues and thus become a parasite), such as species of the genera Macrosporium, Cladosporium, etc., may attack the dead or dying tissue, and aggravate the trouble, while in other cases no such fungus attack is observable. . . .

"It seems possible that the early blight of potatoes may be due to the physiological effects of extreme heat and dryness acting upon leaf tissues at a distance from the roots, and already injured by predatory insects, especially those abundant under such atmospheric conditions; that anything which will check the ravages of the insects will, in a measure, check the blight; and that tissues so injured are liable to the attacks of certain fungi which may enhance the injury."

Thorough shallow cultivation during extreme heat and drought and the use of Bordeaux mixture, applications to be begun early in the season, are preventive means suggested by the author.

A report is given of experiments conducted to show the relative value of winter and summer treatment with Bordeaux mixture for the prevention of pear scab (*Fusicladium pyrinum*). The winter treatment consisted in early applications of copper sulphate solution, followed later by 3 applications of Bordeaux mixture. The conclusions of the author are as follows:-

"On the whole the conclusion seems a fair one, that the winter treatment of pears for scab hardly warrants the necessary outlay of time and money. As good results are obtained by thorough treatment during the summer only as when such treatment has been preceded by a single application of copper sulphate in early spring. That the winter treatment is of some value, however, is seen from the fact that trees so treated matured a better quality of fruit and retained their foliage better than trees which received no treatment at all."

Miscellaneous compiled notes are given on the nature and treatment for quince rust (*Ræstelia aurantiaca*), scab of peaches (*Cladosporium carpophilum*), and mold of peaches (*Oidium fructigenum*).

Damping off, G. F. ATKINSON (*New York Cornell Sta. Bul. 94, pp. 233-272, pls. 6, fig. 1*).—The author gives detailed accounts of the life history of several fungi, the attacks of which result in what is popularly known as damping off. The species especially considered are: *Artotrogus* (*Pythium*) *debaryanus*, parasitic on numerous plants; *A. intermedius*, on fern prothallia; *Completoria complens*, a potting-bed fungus new to this country, and *Volutella leucotricha*, a new species of cutting-bed fungus found by the author on carnations. In addition to the above, critical notes are given on a number of species of Artotrogus, on cancer in cucumbers, damping off of beans, eggplant, lettuce, etc., by a sterile fungus, and brief notes on several other fungi which sometimes produce phases of damping off.

The author's conclusions are as follows:

"Damping off is caused by the growth in the seedlings or cuttings of fungus parasites. The plants when affected frequently present a pale green color. The tissues

become soft at the surface of the ground, the plant falls over and dies. No one fungus is concerned even in the soft rot of seedlings. In related cases the plant may show a brownish ulcer at the surface of the ground, which frequently increases in size until the plant is severed at this point and then dies.

"Too great a moisture content of the soil, air, high temperatures, close apartments, and insufficient light not only favor the rapid growth of the parasites but they also induce a weakly growth on the part of the seedling so that it can not so readily resist the disease.

"The parasites can grow and multiply on decaying vegetable matter which is in the soil.

"When once in the soil they can remain alive for months even though the soil become dry or frozen.

"Soil used in seed beds or cutting beds should be free from decaying vegetable matter or care should be used that the matter is thoroughly decomposed. Fresh sand is said to be the best for small seedlings.

"Soil in which plants have once been diseased should be discarded if it can not be sterilized by steam heat for several hours. Fresh soil free from vegetable matter should be introduced.

"Water the soil thoroughly, but not to saturation, and do not water oftener than actually needed.

"Keep the houses well lighted and well supplied with fresh air. Do not have high temperatures; keep as even a temperature as possible. When the disease first sets in stir the soil about the plants and do everything possible to dry the soil without killing the plants or raising the temperature; keep the temperature as low as the plants will bear. If this does not save them change the soil and clean the beds by whitewashing them.

"When cuttings become seriously diseased change them to fresh soil, resetting only the perfectly healthy ones."

Recent observations on brunissure, F. DEBRAY (*Compt. Rend., 120 (1895), No. 17, pp. 943-945*).—The author differs with Viala and Sauvageau[1] as to the cause of this disease and says the fungus has certain characteristics that preclude its being placed in the genus Plasmodiophora, and the new name given it is *Pseudocommis vitis*.

The author states that the fungus in its various transformations presents the following characteristics:

(1) The plasmodia are mixed with the protoplasm of the host, at which time the infested cells are with difficulty recognized, being very similar to the sound ones.

(2) The plasmodia in one form are spherical, without vacuoles or sometimes with 1 to 3 small ones. They are yellowish in color or often colorless. In this form a membrane is present of the same color and composition as the contents. This form reproduces by budding.

(3) In a second form the plasmodia are elongated with spindle shaped vacuoles, colorless, or yellow, without a membrane. Forms of this kind intergrade from the preceding to the next.

(4) Plasmodia swollen and branching, membrane wanting, vacuoles very numerous, spherical, the largest often as much as 20 μ in diameter. In this and the preceding state the fungus is able to migrate from cell to cell through minute openings in the cell wall.

[1] E. S. R.; 5, p. 423.

The above 4 stages are to be found in the growing plant, while those in the dead or dormant tissue are as follows:

(5) Spherical cysts with a thickened wall, for the most part without vacuoles, and generally brown or black in color.

(6) A waxy stage in which the hardening to form the membrane of the cysts is continued until the whole mass becomes of a wax-like consistency.

The cysts germinate a single spherical bud, while the wax-like bodies produce simultaneously several buds at different parts of their surfaces.

This fungus in all its forms seems to be without a nucleus, and may affect both the foliage and stem of its host. In the latter case often it is affected for considerable distance, the plasmodia penetrating to the vessels, and also sometimes is found in the phloem. The fungus increases so rapidly that it is said to occasionally form masses visible to the naked eye.

In addition to the grape, the author enumerates 27 orders of plants members of which are subject to attacks of this parasite.

The author states that specimens of grape cuttings reported upon by Prunet as affected with chytridiose[1] presented an abundant supply of *Pseudocommis vitis*, and that what Prillieux and Delacroix have described[2] as bacterial gummosis is in reality two different diseases, brunissure and injury due to cracking of vines through freezing.

The author was assisted in his investigations by M. Brive, who was the first to discover this disease, and the details of their researches are promised in the near future.

A disease of tomatoes, G. MASSEE (*Gard. Chron., ser. 3, 17 (1895), No. 441, pp. 707, 708, figs. 3*).—Under the name of the "sleepy disease" of tomatoes the author has described a disease due to *Fusarium lycopersici* that has been troublesome in parts of Great Britain and especially on the islands of Wight and Guernsey. As a rule the plants are attacked through their roots while young, but the disease does not manifest itself until the plant is full grown and the fruit is set. The first indication of the presence of the disease is seen in the sudden drooping of the leaves, which increases from day to day, accompanied by discoloration. If the root of a plant in this stage be split open the woody portion will be seen to be of a dingy yellowish-brown color, which becomes more marked after the root has been cut open for about half a day.

The life history of the fungus is given in detail. The resting spores of the Fusarium inoculate the roots of the tomato, their hyphæ soon finding their way into the vascular system, and pass upward, ultimately reaching the leaves. The progress of the fungus in the plant may be determined by the discoloration of the vascular tissue of the plant.

[1]Compt. Rend., 119 (1894), No. 14, pp. 572-574 (E. S. R., 6, p. 436); No. 19, pp. 808-811 (E. S. R., 6, p. 642).

[2]Compt. Rend., 118 (1894), No. 25, pp. 1430-1432.

When the host has been attacked about 3 weeks the lower portion of the stem is usually more or less covered with a delicate white bloom, an appearance due to the presence of numerous conidial branches that have pushed their way through the decaying tissues of the stem. This the author calls the Diplocladium stage, and in about a week it is succeeded by the Fusarium stage, which is characterized by the appearance near the roots of spots, at first whitish in color, but becoming a dirty orange at maturity. The hyphæ that produce the spores characterizing the earlier stages of the fungus form resting spores which, finding their way into the soil, remain until spring, when they are ready to infest new tomato plants.

The author states that the conidia of both the Diplocladium and Fusarium phases are unable to affect the living tissues of the tomato, but must live as saprophytes on the rich humus, manure, etc. The conidia of the Diplocladium phase on germination produce the Fusarium, and finally produce resting spores in the soil. The Fusarium conidia produce hyphæ, which in turn produce resting spores. In this way 2 additional crops of resting spores are produced, which renew the cycle of development by germinating and attacking young tomatoes during the spring following their formation.

The author's summary is as follows:

"From what has been said, it will have been gathered that the germinating resting spore is the only condition of the fungus capable of attacking the tomato; hence the characteristics of the disease—drooping of the leaves in succession from the base of the plant upward, and the discoloration of the wood in the root—should be thoroughly grasped, and the plants promptly removed and burned on presenting the first symptoms of the disease. By this means the formation of resting spores in the soil would be prevented. On the removal of a diseased plant from a bed the soil should be thoroughly mixed with quicklime, which destroys any mycelium or resting spores left in the earth.

"Spraying with a fungicide is of no avail, as the roots are first attacked and the parasite is internal.

"As much lime as the plants will allow should be mixed with the soil in which tomatoes are grown, more especially if the plants are grown during successive seasons in the same beds. If the plants in a house are badly attacked all the soil should be removed and the walls, etc., sterilized by applying a wash of lime.

"Finally, the infected soil removed from a bed should not be thrown out at random, but should be sterilized by mixing with quicklime, otherwise the resting spores present might find some other suitable host plant, and thus furnish a new and unexpected center for the diffusion of the disease."

Spraying experiments in 1894, H. H. LAMSON (*New Hampshire Sta. Bul. 27, pp. 16*).—The author reports on experiments continued from 1893[1] for the prevention of the fungus diseases of the apple, pear, and potato.

In the case of pear trees which received 4 applications of Bordeaux mixture the gain in first-quality fruit varied from 17 to 47 per cent in favor of the spraying. An equally favorable report is given of the

[1] N. H. Sta. Rpt. 1893, p. 160 (E. S. R., 7, p. 141).

use of Bordeaux mixture for the prevention of apple scab. Paris green was added to the fungicide at the second and third application, with favorable results for the repression of the codling moth. Attention is called to the thorough manner in which Bordeaux mixture will remove lichens from tree trunks. Some russeted fruit was noticed among the sprayed as well as the unsprayed lots. This, the author thinks, was due to unfavorable climatic conditions in the early part of the season. In the case of the potato diseases the experiments included the early blight, due to *Macrosporium solani* and the potato scab. The report on the blight has appeared in a previous publication.[1] For scab the treatment of the tubers with corrosive sublimate is advised.

The prevention of rust in grasses, J. L. JENSEN (*Landmandsblade, 28 (1895), pp. 14, 15*).—Experiments begun in 1892 for the prevention of rust in brome grass by the hot water method gave such promising results that they were continued in 1893–'94 with rusted seed of *Bromus arvensis* and *B. mollis*.

The seed was soaked in cold water for 4 hours, left in a moist condition for about 6 hours, and then dipped about 30 times in water heated to 42° R. (126.5° F.), the operation being arranged so as to take about 5 minutes. The seed was sown June 9, the second day after the treatment. The condition of the grass when examined on July 4 was decidedly in favor of the prepared seed. The number of rusted heads was determined and the crop cut and weighed. The results showed that the rust was entirely absent in the plants from the prepared seed and the amount of grass cut was increased over that secured from the untreated seed.—F. W. WOLL.

Botrytis douglasii, J. BEHRENS (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 136–141*).

Club root (*Kew Misc. Bul. No. 102 and 103, pp. 129–132, fig. 1*).—A reprint in part of G. Massee's paper in *Proc. Roy. Soc., 57, pp. 330–332.*

Culture experiments with rust fungi, III, H. KLEBAHN (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, p. 149*).—Notes are given on *Puccinia degraphidis*, *P. festucæ*, *P. coronata*, *P. coronifera*, and *Æcidium parnassiæ*.

A disease of Ulmus sp, P. SORAUER (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 143–149, pl. 1*).

On certain diseases of forest trees, T. R. SIM (*Agl. Jour. Cape Colony, 8 (1895), No. 13, pp. 331–333, figs. 3*).—This deals with diseases found on Australian trees.

The ergot of Molinia cærulea, C. HARTWICH (*Bul. Soc. Mycol. France, 11 (1895), No. 2, pp. 138–140*).

A leaf-spot disease of ivy, A. ALLESCHER (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 142, 143*).

The smut of cereals, G. LOPRIORE (*Landw. Jahrb., 23 (1895), No. 6, pp. 969–1008, pls. 2*).—The author has given an extensive study of *Cladosporium herbarum*. Various opinions are quoted as to the proper position of *Dematium pullulans*, the author thinking it an intermediate fruiting form of *C. herbarum*.

Sugar-cane disease in Barbados (*Kew Misc. Bul. No. 100 and 101, pp. 81–88*).

The sugar-cane disease and soil exhaustion (*Bul. Bot. Dept. Jamaica, 2 (1895), No. 6, pp. 115–117*).—The author thinks the disease may be induced, in part at least,

[1] N. H. Sta. Bul. 22 (E. S. R., 7, p. 140).

by the low vitality of plants due to the exhaustion of certain elements from the soil.

Some observations on the development of Colletotrichum in artificial cultures, G. F. ATKINSON (*Bot. Gaz., 20 (1895), No. 7, pp. 305–311, pl. 1*).—Describes cultures made of the fungus of bean anthracnose.

Concerning the biological relationships between the fungi causing the heart and dry rot of beets, B. FRANK (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 192–199*).

On the specialization of parasitism in the grain rusts, J. ERIKSSON (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 3–40*).

Structure and affinities of Microsporum, P. VUILLEMIN (*Bul. Soc. Mycol. France, 11 (1895), No. 2, pp. 94–103*).

Concerning the susceptibility of grains to rust, J. ERIKSSON (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 156–158*).

Witches brooms on cherry trees, F. C. STEWART (*Garden and Forest, 8 (1895), No. 384, p. 269*).—The author reports having found these growths on cultivated cherries growing on Long Island at 5 different stations.

Plant diseases during 1893, E. ROSTRUP (*Tidsskr. Landbr. Planteavl, 1 (1895), pp. 131–166*).—A report on the appearance of plant diseases in Denmark during the year.

Mycological notes, C. ROSTRUP (*Bot. Tidskr., 19 (1895), No. 3, pp. 201–214, figs. 3*).—Critical notes and descriptions of various species of fungi, some of which are new. A French résumé follows the original article.

The destruction of beet nematodes (*Rev. Scient., ser. 4, 4 (1895), No. 1, p. 27*).—It is stated that M. Villot has found that watering plants with the ammoniacal liquor from gas works not only kills the nematodes, but is beneficial to the plants.

Destruction of microörganisms by formol, F. JEAN (*Ind. Lait., 20 (1895), No. 27, pp. 209, 210*).

Experiments in the treatment of chlorosis, J. M. GUILLON (*Prog. Agr. et Vit., 12 (1895), No. 25, pp. 653–655*).—A preliminary report is given on the use of sulphate of iron, sulphuric acid, citrate, oxid, malate, and tannate of iron for chlorosis. L. Degrully observes on the above that sulphate and citrate of iron gave good results, the other salts being of little importance as applied. The sulphuric acid gave very unsatisfactory results.

A contribution to the knowledge of the poisonous action of Bordeaux mixture and its effect upon Spirogyra longata and the uredospores of Puccinia coronata, C. RUMM (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 189–192*).

Inoculation experiments with rusts, E. FISCHER (*Bot. Centbl., 62 (1895), No. 12, pp. 380, 381*).

On the preventive treatment of grain against smuts (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 187–190*).—An account is given of treatment of grain with a preparation called "Ceres powder."

The salts of copper and fungus diseases, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 27, pp. 6, 7*).—The author calls attention to the efficiency of copper salts in combating plant diseases.

Injury to a rye field through gas escaping from a superphosphate factory, A. RHODE (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 135, 136*).

ENTOMOLOGY.

Experiments with the muscardine disease of chinch bugs and with the trap and barrier methods for the destruction of that insect, S. A. FORBES (*Illinois Sta. Bul. 38, pp. 25–86, pls. 8*).

Synopsis.—Artificial cultures of the white muscardine disease (*Sporotrichum globuliferum*) were successfully prepared and proved as effective in destroying chinch bugs as natural growth from diseased bugs. In field experiments with the fungus the bugs were often decidedly checked, but it was found that the disease would not spread on vigorous bugs in dry weather. In some cases, although the fungus was abundant in the fields, enough of the bugs escaped to destroy the crops. Surrounding fields with parallel furrows, in the inner of which coal tar was placed, was found to be an effective means of checking the advance of the insects.

This bulletin treats with elaborate detail of an extensive series of experiments with the white muscardine disease (*Sporotrichum globuliferum*) of the chinch bug and with the trap and barrier method for the destruction of that insect, including preparation of cultures of the fungus on artificial media by laboratory methods, contagion and infection experiments with living chinch bugs in boxes, infection experiments with living caterpillars and dead insects, field experiments with the fungus both by the station and by farmers with and without supervision by the station, and tests of various forms of barriers and traps.

The cultural media employed in the laboratory were peptonized agar-agar and a batter of raw corn meal made up with beef broth or other nutrient fluid, such as potato water. The media were contained in the ordinary cotton plugged test tubes or else in 2 quart glass fruit jars with a cotton-plugged tin tube extending through the center of the metal top. The various media were all found well adapted to the purpose, growth from the spores being noticed on the second or third day, developing heads on the fifth or sixth, and ripening them on the eighth or later. Acidulated media were found to produce a more luxuriant growth of the fungus than alkaline or neutral ones. The chinch bugs were found to be as readily and satisfactorily infected from the fungus grown on these artificial media as from that developed in infected bugs.

In the laboratory infection experiments with the bugs it was found necessary to have a layer of moist earth in the bottom of the infected boxes for the successful growth of the fungus. Both garden soil and sand were tried, and the former preferred. The growth of the fungus in infected boxes was frequently interfered with by the presence of dead or dying bugs, which were attacked by blow-fly larvæ and numerous Anguillulidæ, by which the growth of the Sporotrichum was frequently interrupted. Some of the boxes became infested with mites introduced on some of the corn used as food for the chinch bugs, and these mites fed upon the growing fungus, rapidly clearing it off when it appeared on the bugs. Caterpillars of *Grapta interrogationis* and *Pieris rapæ* were inoculated, both live and dead larvæ being employed. It was

found that in most cases the caterpillars were attacked by the disease. In all such instances they turned a peculiar red color, and sometimes a slight mycelial growth of the fungus appeared externally.

The station and farmers' field experiments were attended with varying success, being frequently interfered with by dry summer weather, though often the fungus spread rapidly among the bugs and checked them decidedly. In still other cases, although the fungus was found abundantly in the fields, enough of the bugs escaped to destroy the crops attacked.

Barrier and trap experiments were made as follows: The ground at the edge of the field to be protected was pulverized and a deep furrow was made by dragging a log endwise back and forth a number of times. Three or four of these furrows were made. In the bottom of the one nearest to the crop was put a line of coal tar. It was found that these successive furrows checked the advancing insects, and those which managed to pass the preceding furrows were completely stopped by the coal tar. Tin cans sunk in the bottom of shallow post holes dug in the furrows were quickly filled by the bugs.

The more important results of the experiments may be briefly summarized as follows:

The white muscardine disease will not spread among vigorous chinch bugs in the field in dry weather, frequently being completely arrested until the advent of rains. It is most likely to affect the bugs in low spots, where the soil is more moist from dense or fallen vegetation, and is most vigorous in a period of continuous rains. It is believed that under normal conditions it is generally present among chinch bugs and other insects in the State, and attacks the insects most readily when they are weakened from lengthy rains or other cause. It was found to rarely start upon dead chinch bugs, although on dead caterpillars it was found to grow as well as on the live larvæ, possibly due to their soft bodies. The bugs frequently proved very resistant to infection by the fungus, even when confined for several days or weeks in contagion boxes well stocked with the spores.

In all 91 experiments were made. The illustrations show plats of the farms on which the field experiments were carried out, with figures illustrating the growth of the fungus and a map of the State indicating the number of townships in each county to which the fungus was sent, over 2,000 persons having been supplied, on request, with infected bugs.

The cigar-case bearer in western New York, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 93, pp. 215-230, figs. 11*).—This bulletin treats of investigations in regard to the life history, habits, ravages, and treatment of *Coleophora fletcherella*, the insect and its method of forming its case being described and figured. It is stated that the cigar-case bearer was one of the most serious pests of fruit trees during 1894, chiefly attacking the foliage of apple, pear, and plum trees. The

history and distribution of the insect is treated of. It first attracted attention as an insect injurious to fruits in 1888 in northern New York, where it was found boring holes in the young pears. At present it is apparently limited in distribution to New York and Canada, being especially abundant in western New York and Ontario.

The adult moth is a small, delicate, steel-gray insect with heavily fringed wings about one-third of an inch across. The eggs are laid the last of June or the first of July on the young branches of the trees or among the hair on the undersides of young unfolding leaves. The caterpillars hatch in about 2 weeks and burrow through the skin of the leaf into the space between the two surfaces, where they mine in the soft inner tissues for 2 or 3 weeks. At the end of this time they leave their tunnels and construct their curious cases by joining together by webs at the sides two oval pieces cut from opposite sides of the leaves. They then cut a circular hole in the skin of the leaf, through which they feed on the soft tissue beneath, extending their bodies partly out of the cases. About the middle of September, when they are about half grown, they attach their cases to the twigs, and in this situation hibernate until the middle of April, when they rouse to activity and begin to feed upon the opening buds. at this time the cases being quite conspicuous, as they project from the surface. As the caterpillars increase in size they enlarge their cases by adding bits of fuzzy skin at the anterior end, and about the middle of May they vacate the winter case for the new and larger one made in a similar manner from two bits of thin leaf skin. The process of constructing this case was in one instance observed and is described and illustrated. The caterpillars become full grown, about one-fifth inch in length, from June 1 to 20, when they securely fasten the cases to the leaves with silk and pupate, emerging as adults in about 10 days.

Although the cigar-case bearer attacks both expanding buds and young forming fruit, the chief injury inflicted is later on the foliage, which in some cases is almost entirely skeletonized by the caterpillars.

As treatment it is recommended to spray with Paris green in the spring as soon as the cases are seen on the opening buds, with second and third applications at intervals of from 4 to 7 days. Spraying with kerosene emulsion is also believed to be advantageous, the success depending in any case upon the thoroughness of the application.

A new greenhouse pest, C. P. LOUNSBURY (*Massachusetts Agl College Rpt. 1891, pp. 111-132, pls. 1*).—This paper consists of notes on the black-marked or white-tailed mealy bug (*Orthezia insignis*), its appearance, history, distribution, food plants, injuries, and remedies. Detailed technical descriptions of this species in its various stages are given, as well as bibliography, synopsis, and descriptions of the other species of the genus. *O. maenariensis*, *O. cataphracta*, *O. occidentalis*, *O. floccosa*, *O. prælonga*, *O. urticæ*, and *O annæ*. It is stated that *Orthezia insignis* is a native of tropical America and was first

noticed at the station greenhouses in 1892, although it had been in the State some years previously. As food plants it attacks a large number of greenhouse plants belonging to several families, although it is more abundant and injurious on Coleus, especially the variety *Coleus verschaffeltii.* It is destructive to the cuttings in the greenhouse during the winter, and on young plants that are set out in spring rapidly increases to such numbers as to kill the plants before frost.

The adult female is about the size of a pin head, dragging behind it a white waxy sac containing the eggs. The males are smaller and winged, but are few in number. The favorite point of attack is on the stems and undersides of the leaves. On account of the difficulty of destroying Orthezia with insecticides without further injuring the plant, the preventive measure of employing cuttings from uninfested plants only is suggested, supplemented by frequent syringing with as strong a spray of water as the plants will endure. Of the insecticides, fir tree oil and kerosene emulsion have proved to be the most effective.

Notes on some leaf miners, W. E. BRITTON (*Connecticut State Sta Rpt. 1891, pp. 113-116, pls. 3*).—This consists of notes on some dipterous leaf miners injuring plants in the vicinity of the station, illustrated descriptions and life histories being given for the corn leaf miner (*Odontocera dorsalis*) and columbine leaf miner (*Phytomyza aquilegiæ*).

The habits of the corn leaf miner are described for the first time. The eggs are laid immediately under the epidermis of the leaves about the first of July, and the larvæ on hatching begin to make tunnels in the substance of the leaves, traveling toward the bases, and usually in a zigzag course. The path of the larvæ is visible as a semitransparent mark of gradually increasing width. One of the largest tunnels was nearly straight and measured 19½ in. long by ⅛ in. wide at the broadest portion. The tunnels are usually commenced at the tips of the leaves, and sometimes each leaf may contain several, either parallel or crossing each other. The insect passes the pupa stage within the tunnel, emerging when adult by puncturing the side of the leaf. The corn in the station garden was attacked by the insect to only a slight degree, but that in the greenhouse was infested to a considerable extent. It is believed that remedial treatment is not feasible, and that dependence must be placed on hymenopterous parasites, of which two specimens belonging to a new species of Sphegigaster were bred from the pupæ.

The occurrence of the columbine leaf miner was the first record for the species in this country. It attacked the leaves of columbines to a considerable extent, making zigzag and winding tunnels in the parenchymatous tissue. The pupa stage is passed outside the leaf, the larvæ emerging from their mines and hanging themselves to the under surfaces of the leaves, often several being attached to the same leaf. It is believed that there are several broods each season. Picking and destroying infested leaves is the only remedy given, and it is believed that the pest will prove a dangerous one to columbines if it has no parasites. No natural enemies have as yet been discovered.

San José scale in Delaware, M. H. BECKWITH (*Delaware Sta. Bul. 25, pp. 8, figs. 4*).—A bulletin of popular information concerning *Aspidiotus perniciosus*, an infested tree being described and illustrated description, life history, and treatment of the scale given. The scale has so far been found at 3 localities in the State affecting peach, pear, plum, and crab apple trees. The worst infested trees have been destroyed and the others sprayed with strong kerosene emulsion with satisfactory results, but as a number of orchardists of the State have received trees from infested nurseries it is feared that the scale will make its appearance at other places. Spraying with whale oil soapsuds or strong kerosene emulsion is recommended, but fumigation with hydrocyanic acid gas is believed to be the most effective remedy.

Some injurious insects, W. C. STURGIS (*Connecticut State Sta. Rpt. 1894, pp. 109–112, pl. 1*).—Descriptive notes on the life history and ravages of the onion maggot (*Anthomyia ceparum*), fir mite, apple louse (*Aphis mali*), cherry louse (*Myzus cerasi*), curculio, and peach bark beetle (*Scolytus rugulosus*).

The onion maggot has been doing varying amounts of damage at different points throughout the State. Rotation of crops, destruction of infested plants, and applications of lime to the fields, or of kerosene and ashes to the rows of onions, are advised.

The fir mites were found attacking branches of firs (*Abies balsamea*) in West Cornwall in June, causing the young leaves to curl and become yellow. It is believed that very dry conditions are necessary for the attacks of this pest, and in consequence spraying the trees during dry weather with water or with tobacco decoction is suggested.

The life history of the apple and cherry lice is given in some detail, and spraying with a mixture of pyrethrum and kerosene emulsion is recommended.

The curculio was more abundant than had heretofore been supposed, especially attacking peaches. Jarring the trees and in addition spraying them with a solution of Paris green and lime immediately after the petals have fallen are suggested as treatment.

The peach bark beetle has made its appearance in the State, though not as yet in abundance. It is recommended that it be held in check by applying a wash of Paris green, kerosene, or carbolic acid to the bark, and that all infested branches and trees be destroyed by burning.

A preliminary list of the Hemiptera of Colorado, C. P. GILLETTE and C. F. BAKER (*Colorado Sta. Bul. 31, pp. 137, figs. 56*).—This bulletin consists of an annotated list of Hemiptera, giving localities and food plants. It comprises 261 genera and 547 species, an addition of 349 species to the number previously reported from the State. Five genera, Diaphnidia, Callodemas, Neoborops, Agrammodes, and Neocoelidia, and 111 species are described as new.

A new kerosene attachment for knapsack sprayers, H. E. WEED (*Mississippi Sta. Bul. 32, pp. 56–58, fig. 1*).—This bulletin gives

an illustrated description of an apparatus designed to be attached to knapsack spraying pumps for the purpose of mechanically mixing kerosene with water at the instant of applying it. The apparatus as here described is regarded as an improvement over the similar contrivance mentioned in Bulletin 30 of the station (E. S. R., 6, p. 442). The proper proportions of kerosene and water for use against various insects are given in an accompanying list.

The natural history of aquatic insects, L. C. MIALL (*London: Macmillan & Co., 1895*).—Reviewed in *Nature, 1895, July 11, p. 242.*

Blue gum lice, T. R. SIM (*Agl. Jour. Cape Colony, 8 (1895), No. 13, pp. 336-338*).—With special reference to means of combating plant lice on forest trees.

The golden washed carrot and turnip moth (Plusia aurifera), S. D. BAIRSTOW (*Agl. Jour. Cape Colony, 8 (1885), No. 14, p. 357, figs. 3*).

Concerning the insect pests of Pinus sylvestris and P. austriaca, K. SAJO (*Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 129-131*).

Insect enemies of the vine (*Abs. in Rev. Scient., ser. 4, 4 (1895), No. 1, p. 25*).

The senses of insects, C. V. RILEY (*Nature, 52 (1895), No. 1339, pp. 209-212, figs. 5*).—Reprinted from *Insect Life, vol. 7, No. 1.*

The pimento and its insect foes (*Bul. Bot. Dept. Jamaica, 2 (1895), No. 6, pp. 121-123*).

Insect and fungus enemies of the vine, H. JOLICOEUR (*Description des ravageurs de la vigne insectes et champignons parasites. Paris: O. Doin, 1895, pp. 236, pls. 20; abs. in Ztschr. Pflanzenkrank., 5 (1895), No. 3, p. 177*).

Investigations on Charæas graminis and other injurious insects, E. REUTER (*Landtbruk. meddel., 1894, No. 7; abs. in Ztschr. Pflanzenkrank., 5 (1895), No. 3, pp. 178, 179*).

Report on economic entomology for Ireland during the year 1894, G. H. CARPENTER (*Roy. Dublin Soc. Council Rpt., 1895, pp. 93-108, figs. 18*).—Illustrated descriptive notes on insects more prominently injurious in Ireland during the year, notes being given on the currant louse (*Rhopalosiphum ribis*), magpie moth (*Abraxas grossulariata*), woolly aphis (*Schizoneura lanigera*), codling moth (*Carpocapsa pomonella*), pear gall mite (*Phytoptus pyri*), hay or cheese mite (*Tyroglyphus longior*), bot fly (*Gastrophilis equi*), *Hylastes ater*, *H. opacus*, *Tortrix donelana*, death tick (*Anobium domesticum*), and chocolate tip moth (*Pygæra pigra*).

Flowers and insects in Great Britain, I, J. C. WILLIS and I. H. BURKILL (*Ann. Bot., 9 (1895), No. 34, pp. 227-273, pl. 1*).

When and what to spray, L. R. TAFT (*Michigan Sta. Special Bul., Mar., 1895, pp. 9*).—This is a spray calendar giving popular directions for spraying the most important orchard and small fruits and vegetables for injurious insects and fungus diseases. Formulas and directions for preparing and applying Bordeaux mixture, copper sulphate, ammoniacal copper carbonate, potassium sulphid, Paris green, hellebore, pyrethrum, and kerosene emulsion are given.

Predaceous and parasitic enemies of aphides, II C. A. VINES (*Internat. Jour. Micr. and Nat. Sci., 5 (1895), No. 27, pp. 254-268, pls. 2*).

FOODS—ANIMAL PRODUCTION.

The proteids of barley, T. B. OSBORNE (*Connecticut State Sta. Rpt. 1894, pp. 165-191; and Jour. Amer. Chem. Soc., 17 (1895), No. 7, pp. 539-567*).—It was found by preliminary examinations that barley meal contained proteid matters soluble in water, in sodium chlorid solutions, and in alcohol, and that after complete extraction with these reagents

a considerable quantity of proteid remained, part of which could be extracted by dilute potash solutions, but most of which was insoluble in any reagent hitherto applied. Some 36 preparations were made and studied, and the details of this work are given in the report. The following are the author's conclusions:

"The barley kernel contains:

"(1) Leucosin coagulating at 52°, which is the same as the albumin found in the wheat and rye kernels. Its composition, as shown by the average of six analyses, is:

	Per cent
Carbon	52.81
Hydrogen	6.78
Nitrogen	16.62
Sulphur	1.47
Oxygen	22.32
	100.00

"This substance forms about 0.3 per cent of the seed.

"(2) A small quantity of proteose, the reactions and composition of which could not be definitely ascertained.

"(3) Edestin, a globulin which is the same as that found in the wheat and rye kernels and in a large number of other seeds. Its composition is approximately shown by the figures given below. Owing to the small amount of this body and the difficulty in preparing it, no perfectly pure preparations were obtained:

	Per cent
Carbon	50.88
Hydrogen	6.65
Nitrogen	18.10
Sulphur, Oxygen	24.37
	100.00

"This is the proteid commonly known as vegetable vitellin. It is precipitated from saline solutions by dilution and by dialysis, is not coagulated by heating below 90°, and above that temperature only partially. It is not precipitated by saturating its solutions with sodium chlorid, but is thrown down from saline solutions by adding acid.

"(4) Hordein, a proteid insoluble in saline solutions, very slightly soluble in pure water, and extremely soluble in alcohol of about 75 per cent. This is the barley proteid described by Ritthausen as mucedin. It has almost exactly the same physical and chemical properties as gliadin obtained from wheat and rye kernels, but a different composition:

	Per cent.
Carbon	54.29
Hydrogen	6.80
Nitrogen	17.21
Sulphur	0.83
Oxygen	20.87
	100.00

"About 4 per cent of the seed consists of this substance.

"(5) After extracting the barley flour with salt solution and with alcohol the residue still contained 42 per cent of the total nitrogen, corresponding to proteid matter equal to about 4.5 per cent of the flour. It was not possible to extract more than a very small amount of this residual proteid with dilute potash water, as the treatment for removal of the other proteids rendered it insoluble, if it were not so already.

"(6) The barley flour contained 1.83 per cent of nitrogen, and if it is assumed that this all belonged to proteid matter with 17 per cent of nitrogen the flour would contain 10.75 per cent of proteids. The barley accordingly contained about 4.5 per cent

of insoluble proteid, 4 per cent of hordein soluble in dilute alcohol, 0.30 per cent albumin, and 1.95 per cent of globulin and proteose."

Proteids of the rye kernel, T. B. OSBORNE (*Connecticut State Sta. Rpt. 1894, pp. 147–161*).—From his investigations the author divides these into 4 groups: (1) Those soluble in water, (2) insoluble in water but soluble in saline solutions, (3) insoluble in water or saline solutions but soluble in alcohol, (4) insoluble in the above but soluble in dilute alkalies. The last was not prepared pure, as no means were found of purifying it from the gum, which dissolved freely in the alkali.

Proteids soluble in water.—"The proteids soluble in water are best examined in extracts made in the first instance with 10 per cent sodium chlorid solution from which subsequently the soluble salts have been removed by prolonged dialysis."

The details of the making of 6 separate preparations from clean, fresh winter rye ground in the laboratory are described and the elementary analysis of each given. The summary of these analyses follows:

Summary of analyses of coagulated rye albumin (leucosin).

	1	2	3	4	5	6	Average.
	Per ct	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Per cent*
Carbon	52.57	53.29	53.52	52.86	52.91	52.77	52.97
Hydrogen	6.81	6.74	6.88	6.79	6.81	6.79	6.79
Nitrogen	16.22	16.65	16.78	16.95	16.65	16.68	16.66
Sulphur	24.40	23.32	22.82	23.40	1.10	1.29	1.35
Oxygen					22.23	22.56	22.23
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The rye flour contained 0.43 per cent of this leucosin.

"So far as tested this albumin agrees in all respects with that obtained from wheat.[1] The variations in composition of these preparations are considerable, but perhaps not greater than might be expected.

"The aqueous and saline extracts of the rye meal contain much gum and coloring matters, which render the isolation of pure proteids very difficult. It will be seen, however, that the preparations of wheat albumin and rye albumin have very nearly the same average composition and that both proteids show the same reactions and coagulate at the same temperature. They are unquestionably the same substance, for which I have adopted the name leucosin.

Coagulated leucosin.

	Wheat (average of 5 analyses)	Rye (average of 6 analyses).
	Per cent	*Per cent.*
Carbon	53.02	52.97
Hydrogen	6.84	6.79
Nitrogen	16.80	16.66
Sulphur	1.28	1.35
Oxygen	22.06	22.23
	100.00	100.00

"The proteoses of the rye also show the same reactions as those of the wheat kernel, and so far as it is possible to determine they are identical."

[1] Am. Chem. Jour., 15, p. 408; and Conn. State Sta. Rpt. 1893, p. 179 (E. S. R., 5, p. 1079).

Protein soluble in saline solutions.—Much difficulty was experienced in preparing the globulin in a pure state, owing to the large amount of gum extracted from the rye meal. One small preparation of 1.21 gm. had the following composition (for comparison the average of 5 analyses of wheat globulin is given):

Composition of rye and wheat globulin (edestin).

	Rye globulin (edestin).	Wheat globulin (edestin).
	Per cent.	*Per cent.*
Carbon	51.19	51.03
Hydrogen	6.74	6.85
Nitrogen	18.19	18.39
Sulphur	23.88	0.69
Oxygen		23.04
	100.00	100.00

"The writer has no doubt that this globulin is identical with the edestin found in the wheat kernel and other seeds,[1] but owing to the difficulties encountered in preparing it from rye, further evidence on this point was not obtained."

Proteid soluble in alcohol.—Thirteen preparations were made of the proteid soluble in alcohol but insoluble in water and saline solutions. The average composition of these, together with the composition of gliadin from wheat, as found by the author and Voorhees,[2] is given below:

Composition of gliadin from wheat and rye.

	Wheat.	Rye.
	Per cent.	*Per cent.*
Carbon	52.72	52.75
Hydrogen	6.86	6.84
Nitrogen	17.66	17.72
Sulphur	1.14	1.21
Oxygen	21.62	21.48
	100.00	100.00

"In all their properties wheat gliadin and rye gliadin resemble each other so exactly as to leave no doubt of their chemical identity. Ritthausen, as already stated, failed to find gliadin in rye meal and described the proteid soluble in alcohol as mucedin, having a lower nitrogen and higher carbon content. This disagreement is doubtless due to impurities in Ritthausen's preparations, which, as he mentions, contained coloring matter that could not be removed. This color was probably a result of extracting with hot alcohol, which Ritthausen appears to have used in all cases, cold alcohol having given him a small yield of proteid. I had, however, no trouble in obtaining an abundant yield of gliadin with cold alcohol of 70 per cent, and thereby have extracted far less coloring matter than with hot alcohol.

"*Quantities of the different proteids in the rye kernel.*—Owing to the gum already mentioned the filtration and treatment of the rye extracts was difficult and prolonged and the amounts of globulin, albumin, and proteose could not be determined separately, as in the case of wheat. The rye flour contained 1.52 per cent of nitrogen.

[1] Conn. State Sta. Rpt., 1893, pp. 179, 216 (E. S. R., 5, p. 1079).
[2] Am. Chem. Jour., 15, p. 436.

If we assume that the proteids of rye contain on the average 17.6 per cent of nitrogen, as was nearly the case with those of wheat, and that all the nitrogen exists in proteid form, this sample of flour would contain 8.63 per cent of proteid. We have, therefore, 2.44 per cent of insoluble proteid and 6.19 per cent soluble in salt solution and alcohol. We have already shown that the alcohol-soluble gliadin amounted to 4 per cent of the flour and the leucosin to 0.43 per cent; there thus remains 1.76 per cent to be divided between edestin and proteoses."

	Per cent.
Insoluble in salt solution	2.44
Gliadin, soluble in alcohol	4.00
Leucosin, soluble in water	0.43
Edestin and proteose, soluble in salt solution	1.76

The action of formalin on food, T. WEIGLE and S. MERKEL (*Forsch. Lebensmtl. Hyg. Chem. 2 (1895), p. 91; abs. in Chem. Ztg., 19 (1895), No. 42, Repert., p. 112*).—Milk containing 1 part of formalin to 5,000 will keep for 100 hours at the temperature of 25° C. Milk containing 1 : 10,000 will keep for 50 hours at the same temperature. Formaldehyde alters the albuminoids of the milk so that they will not dissolve in a mixture of sulphuric and acetic acids. Casein precipitates from milk containing formaldehyde in large voluminous flakes instead of in a finely divided condition, as happens in normal milk. This substance also interferes materially with the digestion of the albuminoids in milk. The latter separate from milk containing 1 : 500 of formalin in a solid lump, on the addition of the hydrochloric acid-pepsin solution. Formaldehyde also exercises a marked preserving action on butter, since, in its presence, the acid content of the latter increases much more slowly than in normal butter. The substance promotes the amylolytic action of diastase, but retards the alcoholic fermentation.—W. D. BIGELOW.

Metabolism experiment with sheep with the aid of a Pettenkofer respiration apparatus, F. LEHMANN (*Landw. Jahrb., 24 (1895), Sup. I, pp. 117-119*).—In this experiment the 4 constituents, protein, fat, starch, and cellulose, were compared as to their effect on the production of fat and lean meat. Two sheep were fed a ration which was rather more than sufficient for maintenance. After the production of lean and fat on this ration had been determined, the constituents to be tested were added in separate periods, a period on the basal ration intervening between the test periods. Excluding the latter the feeding was as follows:

Period 1 (basal ration), 400 gm. meadow hay, 300 gm. ground barley, 120 gm. peanut cake, and 5 gm. salt.

Period 2 (starch), 400 gm. meadow hay, 150 gm. ground barley, 100 gm. peanut cake, and 5 gm. salt.

Period 3 (cellulose), 400 gm. meadow hay, 318 gm. ground barley, 125 gm. peanut cake, 120 gm. crude fiber, and 5 gm. salt.

Period 4 (protein), 400 gm. meadow hay, 300 gm ground barley, 120 gm. peanut cake, and 100 gm. wheat gluten.

Period 5 (fat), 400 gm. meadow hay, 300 gm. ground barley, 120 gm. peanut cake, 40 gm. fat, and 5 gm. salt.

The variation in the nutrients supplied in the different rations is shown by the following:

Nutrients in rations fed to sheep in different periods.

	Protein	Fat	Crude fiber.	Nitrogen-free extract.
	Grams.	*Grams.*	*Grams.*	*Grams.*
Period 1 (basal)	96.9	15.2	84.7	287.7
Period 2 (starch)	98.2	15.1	89.8	369.0
Period 3 (cellulose)	100.2	16.7	156.8	320.3
Period 4 (protein)	178.5	16.0	88.5	312.7
Period 5 (fat)	103.0	49.7	86.2	295.0

In this short account no data are given for the respiration experiment, but the following deductions are made by the author, and the details are promised later:

"(1) The basal ration caused a very slight production of lean meat and a considerable production of fat.

"(2) The addition of starch (period 2) and cellulose (period 3) resulted, in the case of both, in a considerable increase in lean. From these results and those of former experiments it follows that there is no difference between these 2 ingredients in their effect on the production of lean. In the production of fat, however, the cellulose was considerably inferior to the starch.

"(3) The addition of protein gave the largest increase in lean.

"(4) The addition of fat gave only an increase in the fat production; it was without effect on the production of lean."

Experiments in cattle feeding, H. T. FRENCH (*Oregon Sta. Bul. 37, pp. 78–81, pl. 1*).—A brief record of the feeding of 4 steers and a spayed heifer for about 3½ months. The cattle were wild when first bought, but were gradually accustomed to stall feeding. They were fed either coarsely ground wheat with clover hay and silage, or a mixture of equal parts of wheat, oats, and bran with clover hay, vetch hay, and corn silage.

At local prices there was a small profit from the feeding, not counting the labor.

"The beef was nicely marbled and of excellent color. . . .

"With a reasonable price for stall-fed beef, the results indicate that there may be as good returns realized here as in localities where corn is used as a principal grain food."

On the effect of feeding fat to cows, H. H. WING (*New York Cornell Sta. Bul. 92, pp. 197–207*).

Synopsis.—Five cows of different ages kept at pasture were fed a ration of equal parts of wheat bran and cotton seed meal, with the addition of cornstalks, silage, or hay when the pasture began to fail. For 10 weeks they were given tallow in addition, beginning at the rate of 4 oz. per animal daily, and gradually increasing the amount 4 oz. at a time until each cow was eating 2 lbs. daily. Similar experiments were carried out with five 2-year-old heifers which had recently calved. There was no appreciable effect in either case on either the health and live weight of the animals or yield and composition of the milk.

The results are cited of an experiment made by H. van Dreser,[1] which was believed to show that the yield of fat was increased by the addition of tallow to the ration.

To test this question 5 cows of different ages and in different stages of the milking period were selected from the University herd. The cows were in pasture and received a grain ration of 8 lbs. per day of a mixture of equal parts of wheat bran and cotton-seed meal. Beginning September 21 tallow was added to this ration at the rate of 4 oz. per day per head, and this was gradually increased 4 oz. at a time until all of the cows were eating 2 lbs. each per day; this occurred from the fourth to the fifth week. The tallow was continued until the end of the tenth week, when it was dropped, and the experiment closed 2 weeks later.

As the pastures began to fail the cows were given dry cornstalks and, later, corn silage with a mixture of clover and timothy hay. The milk was tested at frequent intervals with the Babcock test. The results of these determinations are given for each cow.

"No visible effect was noticeable in the health of the cows at any time during the experiment from the effect of feeding tallow, and weights made November 1 and December 3 showed that the cows had practically neither gained nor lost in weight . . . In general there was no effect in either the yield of milk or percentage of fat that could be traced to the feeding of the tallow. During the first 2 or 3 weeks the percentage of fat rose slightly with several of the animals, but toward the close of the experiment the percentage of fat fell slightly with some of the animals. There was a constant downward tendency in the yield of milk with all the animals, due undoubtedly to the advancing season and the change from pasture to winter feed."

Another trial was made with five 2-year-old heifers which had recently calved. These were fed from October 19 to January 18 in much the same way as the first lot, the tallow being gradually increased up to 2 lbs. The yield of milk and the percentage of fat in it are tabulated by weeks.

"No difficulty was found in getting the animals to eat the tallow. The health of all of the animals remained good, and no appreciable change in live weight took place. . . .

"There was no very marked change in the percentage of fat and yield of milk in the period when the cows were on a full feed of tallow. While there are slight variations in the percentage of fat, they rarely reach 0.5 per cent, and, what is of more significance, they are not uniform. Some of the cows gave richer milk and some poorer on a full feed of tallow than they did before or after."

Contributions to the rational feeding of cows, O. HAGEMANN (*Landw. Jahrb., 24 (1895), No. 1 and 2, pp. 283–308, pls. 2*).—This is the first of a series of investigations planned by the author on the use made of the food nutrients fed to the cow in the production of milk, flesh, and fœtus. He criticises the ordinary feeding experiments made with cows,

[1] Hoard's Dairyman, 25 (1894), No. 18, p. 288.

in that the majority of the large number on record are so made that the only deduction to be drawn is a relation between a certain ration and the milk yield. He believes that to get results which are of general interest and applicable in solving problems in the nutrition of the cow, the metabolism of the food should be studied. Although this involves much labor, he believes that in a relatively short time, at most 3 weeks (14 days preliminary feeding and 6 to 8 days actual metabolism experiments), accurate data can be obtained as to the actual exchange in the body. The nitrogen balance he arrives at from analyses of the feeding stuffs, milk, dung, and urine. While respiration experiments are necessary for determination of the exact balance between income and outgo, he believes that the figures worked out by Kühn make it possible in the case of ordinary rations to calculate the fate of the carbon approximately when the nitrogen balance is known.

The experiment reported was with 2 cows, one in the third and the other in the fourth month of gestation. Both received a basal ration of 50 kg. roots, 6 kg. straw, and 12 kg. hay per 1,000 kg. live weight. To this 1.28 kg. of true digestible albuminoids per 1,000 kg. live weight was added, in the form of rye in one case and of peanut cake in the other. The cow fed rye weighed 502 kg. and the one fed peanut cake 479 kg. The excreta were collected by means of a special harness devised by the author, which is illustrated and described. The milk from each milking was weighed and sampled for analysis, and composite samples of the feeding stuffs were taken for analysis.

The cow on rye was off feed for a day or two, but the author inclines to the belief that the metabolic results were not rendered unreliable. The nitrogen and pure ash balance per day is calculated for the 2 cows as follows:

Nitrogen and pure ash balance.

	Nitrogen.		Pure ash.	
	Cow on rye.	Cow on peanut cake	Cow on rye.	Cow on peanut cake.
	Grams.	*Grams.*	*Grams.*	*Grams.*
Digested from food	150.0	189.9	431	333
Digested from drinking water			16	17
Total	150.0	189.9	447	350
Given off in urine	30.7	112.4	300	290
Given off in milk	48.1	36.0	71	59
Balance stored in body	71.2	41.5	76	1

The author notes that it is peculiar that in the case of the cow on peanut cake only 1 gm. of mineral matter should have been stored in the body for 41.5 gm. of nitrogen; in the form of lean meat this amount of nitrogen would call for 12.5 gm. of ash.

The manner in which the carbon was utilized is calculated with the aid of data furnished by Kühn and others. Without going into the

details of this calculation, the results for the cow fed rye, which are regarded as provisional, are cited below:

Utilization of nutrients in the body (average per day).

	Albuminoids	Fat.	Nitrogen free extract.
	Grams	*Grams*	*Grams*
Digested from food	938	226	6,233
Deduct maintenance ration	351		3,313
Deduct 17 per cent for labor of digestion	100		463
Deduct 6.7 per cent of nitrogen free extract (lost in fermentation)			196
Balance	487	226	2,261

According to the above there was decomposed in the body 938−487 = 541 gm. of albuminoids, but the nitrogen recovered in the urine was only equivalent to 30.7×6.25 = 192 gm. of albuminoids. It appears, therefore, that 259 gm. less of albuminoids was used up than was allowed for in the above calculation, and the author suggests that this may have been saved by the use of an equal amount of carbohydrates for maintenance in its place. Making the correction on this basis gives as available for production 746 gm. albuminoids, 226 gm. fat, and 2,002 gm. carbohydrates. The milk produced contained 301 gm. albuminoids, 310 gm. of fat, and 187 gm. of carbohydrates. This left sufficient carbohydrates for the production of 522 gm. of fat per day, and 445 gm of albuminoids for meat production; deducting 30 gm. from the latter for skin, horn, etc., there remains 410 gm., equivalent to 1,980 gm. of lean meat. Hence, the cow produced on the ration, per day:

9.53 kg. milk with 310 gm fat,
1.98 kg. lean meat (fœtus),
0.522 kg. fat.

Calculating on the same basis the utilization of the nutrients by the cow fed peanut cake, the daily production is as follows:

8.12 kg. milk with 251 gm. fat,
1.10 kg. lean meat (fœtus).

The last cow lost 0.222 kg. of fat per day. The financial results show that at the local price for rye, about 73 cts. per bushel, the limit had been reached at which rye could be more profitably fed than sold.

Early lamb raising, G. C. WATSON (*New York Cornell Sta. Bul. 88, pp. 105–126, figs. 2*).

Synopsis.—Experiments during 1891–'93 in feeding Shropshire and Dorset lambs (thoroughbreds and crosses with grade Merinos) for the early market are reported. The lambs in every case were fed with the ewes and given all they would eat. The Dorsets were the best feeders, bred earlier, fattened better, and were less affected by changes in weather than the Shropshires. There was practically no difference in shrinkage on slaughtering. Silage was compared with mangel-wurzels on 8 grade Merino ewes and 7 lambs during 11 weeks, and on 16 ewes with 15 lambs during 10 weeks, with the result that the silage-fed lots consumed slightly more food and made a little less weekly gain than the root-fed lots.

Four experiments are reported in feeding Shropshire and Dorset lambs for the early market.

The first experiment, 1891–'92, included 4 thoroughbred Shropshire and 3 thoroughbred Dorset lambs; the second, 1892–'93, included 7 thoroughbred Shropshires and 3 thoroughbred Dorsets; the third, 1893, included 11 crosses of thoroughbred Shropshire lambs with grade Merino ewes and 7 crosses of thoroughbred Dorset lambs with grade Merino ewes; and the fourth included 19 grade Shropshires and 17 grade Dorsets.

In all the tests both the ewes and the lambs were given all the food they would consume and the food was the same for both breeds of lambs. The kinds of food given are not stated. A weekly record is given of the weight of the lambs from birth until sold, which occurred from the ninth to the twelfth week. Excepting the last experiment, the Dorsets were the largest at birth. A summary of the average gains is given below:

Average weekly gain per lamb.

	First experiment.	Second experiment.	Third experiment.	Fourth experiment.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Shropshires	3.91	2.87	2.66	3.20
Dorsets	5.36	4.47	3.64	3.95

"In all the tests both the ewes and the lambs were given all the food they would consume; the food given the 2 breeds was the same in quality but oftentimes differed considerably in quantity. The Dorset ewes consumed more food than the Shropshires, and their appetite seemed less affected by changes in the weather than was the case with the Shropshires. From experiments in feeding these 2 breeds for 3 years it was noticed that the Dorsets were the best feeders; not only did they stand forced feeding better, but were less affected by unfavorable atmospheric changes. . . .

"Other things being equal, ewes that give the most milk breed earliest in the season.

"The Dorset horn sheep have bred earlier and fattened better lambs than the Shropshires."

Corn silage for ewes.—Two small flocks, consisting of 8 grade Merino ewes each, were selected to compare the value of corn silage with mangel-wurzels for ewes giving milk. From each pen 7 lambs were raised, and the record is given of the gain of these lambs during the 11 weeks.

The ewes were fed all they would eat once a day of corn silage or mangel-wurzels, one lot on each, together with a grain mixture of 2 parts of bran, 1 of corn meal, and 1 of cotton-seed meal; hay was also fed twice a day.

The average weekly gain of the lambs was 3.22 lbs. for the lot fed roots, and 3.13 lbs. for the lot fed silage.

The experiment was repeated, using 2 lots of 16 ewes each, from which 15 lambs were raised. Lot 1, receiving roots, contained 7 grade Shropshires and 8 grade Dorsets, and lot 2, receiving silage, contained 8 grade Shropshires and 7 grade Dorsets.

The record is given for lot 1 for 11 weeks, and for lot 2 for 10 weeks:

"They learned to like the silage as readily as they did the beets. . . . The flock given the silage consumed somewhat more of this food than was consumed of beets by the beet-fed flock. A little more grain was consumed by the sheep fed silage than by those fed beets. The difference, however, was hardly great enough to denote a greater appetite caused by the silage."

The average gain per week of the lot on roots was 3.44 and of the lot on silage 3.85 lbs.

In addition to the above experiments, the record is given of the weight of the lambs slaughtered by the station in 1893 and 1894, the loss in dressing, and the prices at which they were sold, together with general directions as to the slaughtering and marketing of lambs.

"The Dorset lambs were slaughtered at a somewhat younger age than were the Shropshires, and their weight dressed was also a little greater than that of the Shropshires. Practically there was no difference in the amount which these 2 breeds lost in weight by dressing."

Feeding pigs, G. C. WATSON (*New York Cornell Sta. Bul. 89, pp. 129–138, figs. 1*).

Synopsis.—Corn meal and gluten feed were compared with ground wheat on 24 pigs, from October 10, 1894, to February 10, 1895, and corn meal was compared with corn meal and meat scrap on 12 pigs during the same period. The corn meal and gluten feed lot had a better appetite, consumed more food, gave greater growth, and produced cheaper pork than the wheat-fed lot. Pigs fed corn meal and meat scrap gave a greater increase in live weight, and produced a somewhat larger proportion of lean meat than those fed corn meal.

This gives the results of 2 experiments, 1 to compare wheat with corn, and the other to compare a carbonaceous with a nitrogenous ration. Twenty four pigs were selected from a uniform lot of 30. Twelve of these were used in the first experiment, being divided into 2 equal lots. Those in lot 1 averaged 61.1 lbs. and those in lot 2 averaged 65.7 lbs. in weight. Lot 1 received ground wheat and lot 2 corn meal, and a gluten feed in the proportion of 100 lbs. of the former to 26 lbs. of the latter. Both lots received skim milk in like quantity, the grain being mixed with it and fed as slop.

The trial lasted from October 10, 1894, to February 11, 1895. During this time each lot consumed 8,110 lbs. of skim milk, or about 10 lbs. per head daily; and in addition lot 1 consumed 3,473 lbs. of ground wheat, and lot 2 consumed 2,826 lbs. of corn meal and 735 lbs. of gluten feed. Lot 1 (wheat) made a total gain of 1,189 lbs., and lot 2 (corn) a total gain of 1,307 lbs. The weights secured at slaughtering are tabulated for each animal. Allowing 15 cts. per hundred pounds for the skim milk, 60 cts. per bushel for wheat, and 10 cts. per hundred for

grinding, $23 per ton for corn meal, and $17.50 per ton for gluten feed, the average cost of food per pound of dressed weight was 4.9 cts. for lot 1 (wheat) and 4.56 cts. for lot 2 (corn and gluten feed).

The other experiment was with 2 lots of 6 pigs each, and lasted from October 10, 1894, to February 10, 1895, at which time the pigs were slaughtered. Lot 1 was fed corn meal and lot 2 two parts of corn meal and one part of meat scrap, to compare the growth of the animals and the relative amount of lean meat produced on carbonaceous and nitrogenous rations. At the beginning of the trial the pigs averaged about 64 lbs. in weight. The lot on corn meal made a total gain of 620 lbs., and the lot on corn meal and meat scrap 1,037 lbs.

"Lot 1 (corn meal) gained the most the first month of the experiment, and each succeeding month the increase in weight was less than for the month before. Although these pigs ate much less than lot 2, yet there was no time when they did not present a thrifty appearance. While they did not make the growth of the other lot, they did not at any time appear stunted or unhealthy."

The live and dressed weights and the weights of the various organs at the time of slaughtering are tabulated, and cuts are given showing the dressed pigs and sections of the carcasses of the pigs in this and the preceding experiment.

Lot 3 consumed 2,639 lbs. of corn meal, and lot 4, 2,765 lbs. of corn meal and 1,382 lbs. of meat scrap. The cost of dressed pork per pound was 6.1 cts. from lot 1 (carbonaceous) and 6.86 cts. from lot 2 (nitrogenous), valuing the meat scrap at $40 per ton, which is regarded as excessive.

"While lot 4 (nitrogenous ration) showed somewhat the largest proportion of lean meat, yet the difference was not marked, showing that in this case the very different rations, so far as the nitrogen was concerned, produced very nearly the same proportion of lean meat. . . .

"[Considering the pigs in both experiments], lot 2 (corn meal and gluten fed) made the largest growth, and was somewhat the fattest, although there was not a marked difference between lot 1 and lot 2.

"Lot 3 made the least growth, yet was about as fat as the other lots, the greatest difference being in size.

"Lot 4, while not any fatter than lot 3, made a much better growth; particularly was this noticeable in the length of the animals before slaughtering."

The author summarizes the result of the experiment as follows:

"Corn meal and gluten gave the greatest growth and produced cheaper pork than ground wheat.

"Corn meal and meat scrap produced a somewhat larger proportion of lean meat than corn meal.

"The corn meal and gluten lot had a better appetite and consumed more food than the lot fed ground wheat.

"The corn meal lot consumed the least food and made the least growth."

Danish experiments in pig feeding, 1891–'94, F. FRIIS (*Kgl. Vet. Landt. Lab. Landokon. Forsög., Copenhagen, 1895, pp. 199*).—The pig feeding experiments made by the Danish State Agricultural Experi-

ment Station from 1891 to 1894 include 36 series of trials conducted on 9 different estates, with 893 pigs in all, separated into 175 lots. The plan of the experiments was similar to that of earlier experiments (E. S. R., 5, p. 428).

Barley, mangel-wurzels, and carrots compared.—Nine experiments with 277 animals in 54 lots were conducted for the study of the relative value of barley, mangel-wurzels, and carrots. Two kinds of mangel-wurzels and 4 kinds of carrots were fed. Dairy refuse was fed to all lots. The roots were fed in such quantities that 0.84 lb. of dry matter in roots corresponded to 1 lb. of grain. The experiments lasted from 80 to 130 days, the average being 102 days. The average weight of the pigs at the beginning of the experiments was about 66 lbs. and at the end 169.6 lbs.

The average daily gains per head made by the lots on the different rations were as follows: Barley 0.986 lb., Eckendorf mangel-wurzels 0.828 lb., Elvetham mangel-wurzels 0.833 lb., Vogeser and Champion carrots 0.875 lb., and James and Giant carrots 0.900 lb. The gains made on the roots in these experiments did not come up to those made in earlier experiments. The carrots proved to be of similar feeding value for pigs to mangel-wurzels when equal quantities of dry matter were fed in both cases.

Turnips vs. whey.—Two experiments with 30 pigs were made to study the relative value of turnips and whey. The experiments lasted 130 and 110 days, respectively. Lot A was fed whey and Lot B half the amount of whey and a like amount of turnips. Both lots received equal amounts of barley in addition. The feed, live weight, and gain made by the different lots were as shown below:

Turnips vs. whey for pigs.

	Average weight per head at beginning		Average daily gain per head.	
	Lot A, whey.	Lot B, turnips and whey	Lot A, whey.	Lot B, turnips and whey.
	Pounds.	*Pounds*	*Pounds.*	*Pounds.*
Series of 1892-'93	40 4	39.6	1 01	0.88
Series of 1893 94	59 0	59 2	1 15	1.04
Average	49.7	49 4	1.08	0.96

The gains made by the different lots indicate that under the conditions given the whey had a higher feeding value, pound for pound, than the turnips.

Barley vs. oil cakes.—Seven series of experiments were made with 205 animals averaging 72.7 lbs. at the beginning, the average duration of the experiments being 89 days. Instead of the ratio previously tested of 1 part of barley to 1 of oil cake the ratio was 2:1 or 1:2. In each

series one lot was fed barley only for the sake of comparison. Buttermilk and skim milk or whey were fed in addition to the concentrated feeds. In 6 experiments the oil cake was sunflower-seed cake and in 1 palm-nut meal.

Average daily gain in weight of pigs on barley alone and with oil cakes.

Kind of oil cake used.	Average daily gain per head.		
	Barley alone.	Two-thirds barley and one-third oil cakes.	One third barley and two-thirds oil cakes.
	Pounds.	*Pounds.*	*Pounds.*
Sunflower-seed cake with skim milk (4 series)	1.15	1.12	1.01
Sunflower seed cake with whey (2 series)	1.17	1.21	1.13
Palm-nut meal with whey (1 series)	1.23	1.19	1.16
Average of 3 series with whey	1.19	1.20	1.14
Average of all 7 series	1.17	1.16	1.06

From these experiments, in connection with those previously made, it appears that the rations containing less than half of the concentrated feed in the form of oil cake have been nearly as effective as the rations without oil cakes and that larger quantities of oil cake produced poorer results, although the difference was greater when skim milk was fed than when whey was fed. This result was not changed materially when roots were added to the rations. Feeding experiments with oil cakes for milch cows conducted under similar conditions at the Copenhagen experiment station have shown these feeds to be superior to grain in nutritive effect.

Barley vs. Indian corn.—Five series of experiments with 115 pigs were made, the average duration of the experiments being 120 days and the average weight at the beginning of the experiments 46.2 lbs. The experiments were a continuation of those previously made at the station. Since the quality of the pork produced seemed to suffer when corn was fed throughout the fattening period, in the present experiments barley was substituted for the corn in the case of Lots B, C, and D when the pigs had reached a live weight of about 120, 140, and 160 lbs., respectively; Lot A received barley and Lot E received corn throughout the experiment. Skim milk was fed in all cases. The average results obtained are given in the following table:

Average daily gain of pigs on corn and barley.

	Pounds.
Lot A, barley throughout	1.10
Lot B, corn, substituted by barley at 120 lbs	[1] 1.09
Lot C, corn, substituted by barley at 140 lbs	1.14
Lot D, corn, substituted by barley at 160 lbs	1.10
Lot E, corn throughout	1.14

The lots fed corn throughout the experiments made somewhat heavier gains than the barley-fed lots, with one exception, agreeing with the

[1] Average of four series.

results of the earlier experiments. The results at slaughtering were as follows:

Average results obtained at slaughtering.

	Average weight at slaughtering.	Shrinkage.	Thickness of fat.	Softness of pork.
	Pounds.	*Per cent.*	*Inches.*	*Points.*
Lot A, barley throughout the experiment	183	22.9	1.3	1.4
Lot B, corn up to 120 lbs live weight	181	22.0	1.5	1.6
Lot C, corn up to 140 lbs live weight	186	21.7	1.5	2.0
Lot D, corn up to 160 lbs live weight	183	22.2	1.5	2.3
Lot E, corn throughout the experiment	185	21.1	1.5	2.7

The earlier experiments indicated that Indian corn has a tendency to produce a poor quality of pork, and the same tendency appears in the preceding results. Dividing the pigs into 4 classes according to quality, 92 per cent of those fed on barley alone were placed in the first 2 classes, while only 62 per cent of those fed corn throughout came within these classes, and 14 per cent came in class 4 (poor carcasses sold at a discount). The figures given for softness of the pork, 1 being taken as perfect, show an increase with the length of time corn was fed.

Danish vs. Russian barley.—Considerable quantities of Russian barley are each year imported into Denmark and fed to cattle. Three series of experiments were conducted to compare the feeding value of Danish and Russian barley, using 80 pigs in all, averaging about 49 lbs. The average daily gain in live weight was 1.04 lbs. for the pigs on Danish barley and 1.06 lbs. for those on Russian barley.

The 2 kinds of barley proved very nearly equal in feeding value, and analysis showed no marked difference in composition.

Food required per pound of gain.—Sixteen experiments with large hogs were conducted to study the relative value of dairy by-products, grains, roots, oil cakes, etc. In the main these experiments, which included 355 animals in all, gave similar results to those obtained with young animals in the earlier series of pig feeding experiments by this station. One pound of barley was found equivalent to 6 lbs. of centrifugal skim milk or to 12 lbs. of whey from centrifugal skim-milk cheese.

The following table shows the amount of "calculated grain," according to the value given above, required for the production of 1 lb. of growth at different periods:

Pounds of food required for 1 lb. of gain at different stages of growth.

	At 35 to 75 lbs	At 75 to 115 lbs	At 115 to 155 lbs.	At 155 to 195 lbs	At 195 to 235 lbs	At 235 to 275 lbs	At 275 to 315 lbs.
Number of experiments included	3	10	13	15	14	11	3
Average for all experiments	3.76	4.35	4.66	5.13	5.40	6.14	6.39
Average for all 7 comparative experiments	......	4.37	4.67	4.99	5.43	6.24	....

The figures given in the last line of the table are the averages of 7 strictly comparable experiments. There is a steady increase in the amount of food required for 1 lb. of gain with the increasing age of the animals. This is apparent when either series of figures given in the table is considered.

Food required per pound of increase in summer and in winter.—The pig feeding experiments conducted by the station since 1887 have been summarized with a view to obtaining information concerning the amount of food required for a pound of growth in summer and in winter, dividing the year roughly. The foods consumed have been reduced to their grain equivalents, all experiments having been included in the calculations where the feeds examined proved of very nearly equal feeding value. The average results of 100 winter and 99 summer experiments are given, each of which included from 25 to 30 animals, so that for each season (summer and winter) the averages represent at least 2,500 pigs. Arranging the pigs in 3 groups according to the live weight, the following average results were obtained:

Food required for 1 lb. of increase in winter and in summer.

Period of growth.	Number of experiments included		Feed eaten per day per head		Feed per 1 lb. of gain.	
	Winter	Summer	Winter	Summer	Winter.	Summer.
			Pounds	*Pounds*	*Pounds*	*Pounds*
Group 1, 35 to 75 lbs	10	17	2.66	2.65	3.71	3.46
Group 2, 75 to 115 lbs	43	39	3.96	3.92	4.46	3.97
Group 3, 115 to 155 lbs	47	43	5.26	5.25	5.16	4.57
Totals and averages	100	99	4.96	3.94	4.44	4.00

The animals ate but slightly more in winter than in summer, but it required 0.44 lb. more grain feed for 1 lb. of gain in winter than in summer. According to American prices for feeding stuffs it would therefore cost not quite half a cent more in winter than in summer to produce a pound of pork, provided these figures are directly applicable to our conditions. The conclusions were not materially modified when only experiments were included which fell inside the 3 summer and the 3 winter months. The average daily temperature, as was ascertained during a number of experiments, was as follows:

Average temperature during pig feeding experiments.

Period of growth.	Number of experiments.		Winter.			Summer.		
	Winter.	Summer	Air	Stable.	Feed.	Air.	Stable.	Feed.
			Deg. C	*Deg C*	*Deg C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*
Group 1, 35 to 75 lbs	9	17	2.0	8.7	10.1	14.9	16.2	15.2
Group 2, 75 to 115 lbs	36	35	1.3	9.3	10.6	15.1	16.2	15.5
Group 3, 115 to 155 lbs	35	37	2.2	9.5	11.6	13.4	15.5	14.6

Light vs. heavy feeding.—Incidentally the effect of light and heavy feeding on the rate of growth in pigs was observed in a large number

of experiments. In a general way there is no marked difference between the amount of food required per pound of gain on light and heavy feeding. Two series of experiments were made with 60 animals in 1894 with the prime object of studying this question. The first of these lasted 210 days and the second 120 days. The food consisted of barley, skim milk, buttermilk, and whey The following results were obtained

Rate of growth of pigs on light medium and heavy feeding

	Average weight of pigs	Grain equivalents eaten per day	Average daily gain	Food required for 1 lb of gain
	Pounds	*Pounds*	*Pounds*	*Pounds*
Light feeding	[illegible]	[illegible]	[illegible]	[illegible] 91
Medium feeding	[illegible]	[illegible]	1 07	[illegible] 97
Heavy feeding	[illegible]	[illegible]	1 12	4 04

The results indicate a tendency toward a lower utilization of the food on the heavier feeding The data obtained at slaughtering at the conclusion of the preceding experiments showed no appreciable difference between the lots on light, medium, and heavy feeding in the shrinkage, thickness of fat, or softness of the pork. Grading the carcasses into 4 classes, of those on light feeding none fell in class 4 (poorest), while about the same percentage fell in the first 2 classes as in case of those on medium and heavy feeding.

Barrows vs sows for fattening—The data obtained in the fattening of 1,216 pigs have been arranged according to sex, with the following results

Barrows vs sows for fattening

	Average weight: At beginning of experiment	Average weight: At end of experiment	Average gain per day per head	Shrinkage in dressing	Thickness of fat	Softness of pork	Length of body
	Pounds	*Pounds*	*Pounds*	*Per cent*	*Inch*	*Points*	*Inches*
Barrows	[illegible]	[illegible]	[illegible]	[illegible]	1	1 4	[illegible] 3
Sows	5	[illegible]	[illegible]	[illegible]	1 4	1	[illegible] 7

The results show that there was practically no difference in the average data obtained for the 2 sexes When the carcasses were graded 44 per cent of the barrows and 56 per cent of the sows fell in the first class, and 77 per cent of the barrows and 85 of the sows in the first 2 classes —F. W. WOLL.

Feeding experiments with horses, W RYHNSTRÖM (*Landmandsblade, 28 (1895), pp 251, 252*) —Horse bread, prepared from skim milk and oats, was compared with oats as a horse feed. Twenty horses of the Royal Swedish Body Guard, separated into 2 even lots, were fed as follows: Lot 1, 11 lbs. oats, 6.6 lbs hay, 7.5 lbs straw, about 1.3 lbs. of the latter being cut and fed with grain; lot 2, first week, 1.1 lbs. of

horse bread, 7.7 lbs. of oats; second week, 3.3 lbs. of horse bread and 5.5 lbs. of oats; third week, 4.4 lbs. of horse bread and 3.3 lbs. of oats.

The author concludes that the horse bread fed in twice as large amount as the oats keeps the horses in about as good condition as oats alone. The bread is generally relished by horses, and does not appear to cause constipation, even if fed in large quantities for a number of days. It is less filling and weighs only half as much as a quantity of oats of similar nutritive value. Owing to its mechanical condition it is eaten up clean.

The bread, which contained 5.7 per cent of water and 16.3 per cent of crude protein, has been indorsed by good Swedish authorities as a nutritious and palatable concentrated horse food, fully capable of replacing oats.—F. W. WOLL.

A study of the kola nut, A. CHIASTAN (*Montpelier: 1893, pp. 39; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 3, pp. 207-209*).

The proteids of wheat, M. O'BRIEN (*Ann. Bot., 9 (1895), No. 34, pp. 171-226*).

New contributions to the study of rape-seed cakes, F. H. WERENSKIOLD (*Tidsskr. norske Landbr., 2 (1895), pp. 145-152*).—*Thlaspi arvense*, a common impurity of European rape seed, was found to contain a glucosid—potassium myronate—which is decomposed by a ferment present in the seed into oil of garlic, the quantity of which in the total substance amounted to 0.836 per cent.

Rape-seed cakes and their adulterations, B. GRAM (*Bot. Tidsskr., 19 (1894), pp. 116-142, figs. 24*).—A monograph on the subject, describing in detail the microscopical technique and the anatomical characteristics of rape seed, and of the seed coats of other plants used for the adulteration of rape-seed cakes.

The potato as a food for animals, A. GIRARD (*Bul. Min. Agr. France, 14 (1895), No. 4, pp. 376-403*).—In experiments with sheep and cattle a ration composed chiefly of potatoes afforded rapid gains in live weight, a large percentage in dressed weight of the slaughtered animals, and flesh of excellent quality. Cooked potatoes proved more effective and more profitable than uncooked.

On the presence of sulphocyanates in the digestive liquids, M. MENCKE (*Ber. deut. Chem. Ges., 28 (1895), No. 10, pp. 1318-1320*).

On feeding of molasses, H. NATHORST (*Tidsskr. Landtmän, 16 (1895), pp. 245-248, 285-290*).

Crossbred sheep, J. H. ELWES and W. J. MALDEN (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 221-243*).

Dorset down sheep, J. C. CRAIG (*Breeders' Gaz., 1895, July 10, pp. 20, 21, figs. 4*).—This article deals with the results obtained in breeding a pure blood Dorset ram to grade Shropshire ewes.

On the influence of the food on the production of milk and butter, J. SEBELIEN (*Tidsskr. norske Landbr., 2 (1895), pp. 187-236*).—A review of the question of the origin of the fat in the milk and the relation between the food, the chemical composition of the milk, and the character of the butter produced.

Corn or wheat for hogs? (*Breeders' Gaz., 1895, July 31, p. 68*).—Whole wheat and corn alone and mixed together were fed to hogs. To make 100 lbs. of gain required 438 lbs. of wheat, 453 lbs. of corn, and 425 lbs. of the mixed grain. The hogs were sold at \$5.15 per cwt., and afforded a return of 70.5 cts. per bushel for wheat and 63.3 cts. for corn.

Measurements of swine, JUNGHAUS (*Landbote, 16 (1895), No. 26, pp. 244, 245*).—A record of average measurements of numerous prize animals of several breeds and a statement regarding the advantages of making measurements.

Horse raising in Denmark during 1894, J. JENSEN (*Tidsskr. Landökon, 14 (1895), pp. 59-77*).

The care of poultry (*Monthly Bul. Bureau of American Republics, 1895, June, pp. 787-796*) —A popular article on feeding and management.

Animal husbandry in Denmark during 1894, A. APPEL (*Tidsskr. Landokon, 14 (1895), pp. 78-97*).

VETERINARY SCIENCE AND PRACTICE.

Parturient apoplexy of cows, R. R. DINWIDDIE (*Arkansas Sta. Bul. 35, pp. 138-143*).—This disease usually occurs within 3 days after calving, and cows once attacked are liable to a recurrence at the next calving. The nature, symptoms, and preventive and remedial treatment are discussed. The author regards the cause of the disease as not positively known. In examining 3 cows which had died of this disease he found bacteria in the contents of the uterus immediately after death. These bacteria proved mocuous when subsequently injected into small animals. The treatment recommended is based on the view that in the first stages of the disease there is a hyperæmic condition of the brain, followed later by an œdema and consequent anæmic condition. Tincture of aconite, and if practicable a purgative, are given in the earlier stages, and a stimulant in the later stages. The head should be kept cool by applications of ice or cold water.

Verminous bronchitis, R. R. DINWIDDIE (*Arkansas Sta. Bul. 35, pp. 130-138, figs. 3*).—Verminous or parasitic bronchitis, caused by the presence in the air tubes or lungs of small, round worms belonging to the genus Strongylus, attacks cattle, sheep, and hogs. The life history of the worms is traced and the symptoms of the disease described. Wet pastures and those containing pools of stagnant water are the most favorable to the growth and dissemination of these parasites, which gain access to the air passages of grazing animals.

Coughing is but one of the prominent symptoms of verminous bronchitis. This trouble is most prevalent in a year with a wet summer preceded by a mild winter.

When this disease occurs the sound and affected animals should be separated and both should be placed on dry, uninfected pastures free from pools of stagnant water. Special treatment is not considered advisable for sheep, except for high priced animals. It has been recommended to combat these parasites by driving sheep or young calves into a close shed and burning tar, rags, hair, leather, or sulphur as long as the operator can safely bear the operation. Calves are sometimes treated by inserting a hypodermic syringe between the rings of the windpipe and injecting into the inside a mixture of equal parts of turpentine and sweet oil, to which also carbolic acid in the proportion of 12 to 20 drops to a tablespoonful of the mixture is sometimes added. Two or more injections at intervals of several days are considered necessary, and the work needs to be carefully and thoroughly done.

Cattle poisoning by nitrate of potash, N. S. MAYO (*Kansas Sta. Bul. 49, pp. 3-11*).—In one case 7 head of cattle in a herd of 12 died within a few hours after eating dried cornstalks grown on a rich soil formerly used as a hog lot.

"A casual examination of the samples of cornstalks received revealed the presence of large quantities of nitrate of potash (saltpeter). Beneath the leaf sheath which surrounds the stalk just above the joints the nitrate had crystallized in fine white crystals which resembled a white mold, but was easily recognized by tasting. Around and in the cut ends of the stalks were solid masses of almost pure potassium nitrate. If a stalk was cut in two and tapped lightly upon a table the crystals of potassium nitrate would be jarred loose and fall as a fine powder upon the table. Upon splitting a cornstalk the crystals in the pith of the stalk could easily be seen with the unaided eye. The bitter cooling taste, so characteristic of potassium nitrate, could be obtained by placing a small bit of the stalk in the mouth. On lighting a bit of stalk with a match it would deflagrate, burning rapidly like the fuse of a firecracker. A chemical examination of a quantity of stalks gave 18.8 per cent of the dry weight of the stalk as nitrate of potash."

In another case 10 animals in a herd of 31 died soon after eating corn fodder, which on examination was found to contain such a very large quantity of nitrate of potash that this salt could be detected by taste or by burning. The field where this corn fodder was grown gave no indications of containing an excess of nitrate of potash and had not been used as a barnyard.

Reference is made to a case occurring several years previously in which the loss was 40 head in a herd of 120. The corn fodder fed to this herd just previous to the occurrence of so many deaths contained a large amount of nitrate of potash, as was shown by chemical examination and by simple inspection of the stalks. It grew on a highly enriched soil.

In all 3 cases the cornstalks to which the trouble was attributed had been cut in a very immature condition, and in all cases they were thoroughly cured when fed.

In order to determine the poisonous action of potassium nitrate several tests were made. A heifer weighing about 500 lbs. was offered 200 gm. of nitrate of potash mixed with her food, but could be induced to eat only about a third of that amount, and was not seriously affected by this dose. Another heifer of about the same weight was drenched with 300 gm. of nitrate of potash dissolved in water. Her death followed within 24 hours.

A cow weighing about 1,200 lbs. was drenched with 500 gm. of nitrate of potash. Her death also occurred within 24 hours.

An adult white rabbit was drenched with 5 gm. of nitrate of potash and death resulted within about an hour.

The symptoms of poisoning by potassium nitrate are described and the results of *post-mortem* examinations detailed. When the presence of potassium nitrate in considerable quantity is suspected in cornstalks the stalks should be burned, and the presence of the poison may be detected by the characteristic "sizzing" or deflagration.

Mastitis—inflammation of the mammary gland, N. S. MAYO (*Kansas Sta. Bul. 49, pp. 12–18*).—The causes, symptoms, and treatment of this disease, also known as garget, are treated. The following are given as causes of mastitis: Injuries to the gland, retention of milk, and the presence of *Bacillus tuberculosis* and other germs.

The milk from 2 cows suffering from chronic mastitis was examined microscopically and a streptococcus was found, of which the following is a description:

"The organism is a well-defined streptococcus about 1 μ in diameter and forming long chains. Grown upon solid nutrient agar or gelatin, it forms a canary-yellow growth with a raised center and even outline. In bouillon the organism forms a yellow growth at the bottom of the flask, indicating that it will grow either with or without air. Another organism obtained on the first plate cultures, but which later cultures made from the milk failed to show, and which was probably accidental, was a not well defined streptococcus growing in short chains. The cocci themselves were not perfect spheres, and under some conditions would assume a decidedly oval outline and show a bipolar stain. Grown on solid nutrient media it formed a pinkish-gray growth, which deepened into a dark red as the culture got older and the growth deeper. The coloring of both organisms depended somewhat on the amount of coloring matter in the culture medium upon which they were growing.

"Broth cultures of both of these organisms when injected into the lactiferous ducts of a healthy cow produced mild inflammation of the gland associated with the thick stringy milk, which contained the organisms or bacteria in large numbers."

The udder of one of the cows was injected with a 0.1 per cent solution of corrosive sublimate and her recovery followed in a short time. In ordinary cases of mastitis the treatment recommended is the removal of the milk, careful dieting, rubbing the gland, and the local application of hot water, followed by a lotion of camphor and lard.

Southern cattle fever, A. W. BITTING (*Florida Sta. Bul. 28, pp. 85–88*).—The outbreak which is described is attributed by the author to changing cattle from one farm to another located only a few miles distant and situated near Tallahassee. The farm from which the cattle were removed was not infested with ticks and there no loss had occurred. However, after the cattle were transferred to the other farm many deaths occurred and young ticks were found on the diseased animals.

Tuberculosis of cattle, R. R. DINWIDDIE (*Arkansas Sta. Bul. 35, pp. 117–154*).—A general discussion of the conditions favoring the development of tuberculosis and means of detecting the disease and preventing its spread.

"From a considerable experience in the inspection of cattle at the slaughterhouses in different parts of the State the writer is in a position to state that the disease is practically unknown among the native Arkansas stock. . . .

"Nevertheless, tuberculosis of cattle is not entirely unknown in Arkansas, several herds having been examined by request in which the disease was established by the use of tuberculin, an invaluable diagnostic agent which science has now placed at our disposal."

The results of tuberculin tests made on 2 herds, one of which proved free from the disease and the other infected, are tabulated.

Liver fluke, A. W. BITTING (*Florida Sta. Bul. 28, pp. 83–85, pls. 2, map 1*).—A narrow strip of land from 15 to 30 miles in width along the coast was found to be permanently infected with the liver fluke (*Distomum hepaticum*). In Florida this parasite is chiefly troublesome in young cattle. Medical treatment is regarded as unsatisfactory, and the author recommends that low pastures be avoided.

Anthrax (*Pennsylvania Bd. Agr. Rpt. 1894, pp. 121–127*).—A general discussion of the disease and accounts of 2 outbreaks in the State.

Contagious diseases of animals (*Washington State Bd. Health Rpt. 1894, pp. 14–23*).—The results of several mallein tests for glanders and an account of several outbreaks of cattle diseases are given.

Glanders (*Pennsylvania Bd. Agr. Rpt. 1894, pp. 102–104*).—Brief general notes and reference to an outbreak in which mallein was used as a diagnostic agent.

Glanders in horses and mules, R. R. DINWIDDIE (*Arkansas Sta. Bul. 35, pp. 155–158*).—A general discussion of the symptoms and treatment of this disease, and disinfection of contaminated stables.

Hog cholera and other swine diseases, R. R. DINWIDDIE (*Arkansas Sta. Bul. 35, pp. 144–152*).—This article discusses in a general way the means by which cholera is spread and the symptoms and treatment of the disease. The formula recommended by the Bureau of Animal Industry of this Department (Farmers' Bul. 24; E. S. R., 6, p. 664) is quoted.

Fluke or "slak" in the liver of sheep, also called liver rot and sheep rot, D. HUTCHEON (*Agl. Jour. Cape Colony, 8 (1895), No. 14, pp. 350–351, figs. 4*).—A popular article.

Lungworms of sheep (Strongylus filaria), D. HUTCHEON (*Agl. Jour. Cape Colony, 8 (1895), No. 14, pp. 354, 355*).—A popular article.

Poisoning of calves by cotton-seed meal, D. GAUTIER and C. F. LARSEN (*Landmandsblade, 28 (1895), pp. 128–130*).—A record of a number of poisoning cases of calves directly traceable to cotton-seed meal eaten. The cause of the poisonous effect of cotton-seed meal when fed to calves, sheep, or swine was studied in 1888 by Pütz, no definite results being, however, obtained.

Preventive inoculation against anthrax and endocarditis, F. HUTYRA (*Tidskr. Vet. Med. och Husdjursk., 14 (1895), pp. 36–43*).

Ringworm of calves, G. T. BROWN (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 308–326, figs. 5*).—The nature, symptoms, and treatment of this disease are discussed.

Tuberculosis at the State Hospital for Insane, Norristown, Pennsylvania, F. H. WATSON (*Pennsylvania Bd. Agr. Rpt. 1894, pp. 240–252, pls. 5*).—The results of *post-mortem* examinations of cattle are given.

Tuberculosis in domestic animals and its prevention, F. A. ZÜRN (*Die Tuberkulose der Haustiere und deren Vorbeuge. Leipsic: A. Felix*).

Tuberculin tests at the branch experiment farms, W. SAUNDERS (*Canada Exptl. Farms Rpt. 1894, pp. 58–71*).—A record of temperatures of cattle subjected to the tuberculin test.

A suggestion about tuberculin, G. N. KINNELL (*Breeders' Gaz., 1895, July 31, p. 69*).

Royal commission on tuberculosis (*Abs. in Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 400–405*).—The abstract deals chiefly with the danger from consuming the products of tuberculous animals.

Tuberculin as a diagnostic agent (*Pennsylvania Bd. Agr. Rpt. 1894, pp. 104–109*).—Temperatures of animals receiving an injection of tuberculin and a general discussion of tuberculin.

Lathyrism due to purple vetch (*Rev. Scient., ser. 4, 4 (1895), No. 3, p. 90*).—A report is given on a case of animal poisoning through eating *Lathyrus climenum.*

The leucocytes and the active properties of serum of inoculated animals, J. BORDET (*Ann. Inst. Pasteur, 9 (1895), No. 6, pp. 462–516*).

Report of the veterinary surgeon, F. BRIDGE (*Pennsylvania Bd. Agr. Rpt. 1894, pp. 167–173*).—Reference is made to various diseases occurring in the State, and the results of a tuberculin test are tabulated.

Law of Washington relative to contagious diseases of domestic animals (*Washington State Bd. Health Rpt. 1894, pp. 40–43*).—The text of the law approved March 20, 1895.

DAIRYING.

Experiments in the ripening of cream by means of pure cultures, F. FRIIS and H. P. LUNDE (*Kgl. Vet. Landt. Lab. Landökon. Forsög., Copenhagen, 1895, pp. 47*).—The report gives an historical sketch of the progress made in the methods of cream ripening, and describes experiments with lactic ferments as compared with buttermilk from good creameries for the ripening of cream. The present extensive use of pure cultures in Danish creameries is illustrated by the following data: Seventy per cent of the butter exhibited at Danish dairy shows during 1894 (1,133 exhibits in all) was made from cream ripened by means of pure cultures, as was also 74 per cent of the tub butter shown at the butter exhibits of the state agricultural experiment station during part of 1894–'95 (300 samples in all). At the last dairy show (December, 1894) and the last butter exhibit (February, 1895) the percentages of pure culture butter were 84 and 83 per cent, respectively.

Experiments were made with 4 brands of commercial lactic ferments. The butter made was always scored twice—when 3 to 4 days old, and 14 days later. The scores for the pure culture butter were compared with those of butter made at the same time with the use of buttermilk from creameries, making a first-class product as a starter. A scale of 15 points was used in the scoring of the butter. In the following table the scoring of butter made by the old process of ripening is designated by *n*, and the quality of the pure culture butter is compared with it, the scoring above or below *n* being indicated by the + or – sign:

Comparison of scoring of butter made with buttermilk starter and with pure cultures.

Creamery.	Number of churnings.	First scoring. Buttermilk starter.	First scoring. Lactic ferment: Quist.	Blaunfeldt and Tvede	Zoffmann.	Hansen.	Second scoring. Buttermilk starter.	Second scoring. Lactic ferment: Quist	Blaunfeldt and Tvede.	Zoffmann	Hansen.
Söuderley	48	*n*	*n*–0.6	*n*–0.1	......	......	*n*–2.1	*n*–2.5	*n*–1.8	......	......
Do	6	*n*	–0.5	–0.3	*n*–1.2	......	–1.8	–2.3	–2.0	*n*–4.5	......
Egeskov	16	*n*	–0.7	0.6	–1.1	–0.7	–2.7	–3.6	–2.9	–5.3	*n*–3.8
Do	8	*n*	–1.4	0.9	–0.9	–1.5	–2.3	–4.1	–2.3	–49	–4.1
Do	8	*n*	....	+0.3	–1.3	+0.1	–3.1	–3.0	–3.5	–5.8	–3.5

The results given in the last line of the table were obtained with cultures prepared in fresh centrifugal skim milk, new portions being inoculated for a month every other day, or thereabouts, according to

the directions given in each case. The experiments showed that the commercial lactic ferments produced butter as fine and of as good-keeping quality as first-class butter made with a buttermilk starter; and that a starter of lactic ferment may be safely applied for a considerable length of time, if of good quality when bought and kept free from contamination in the meantime.

Examinations of the buttermilk and the butter produced were made in all cases to ascertain the influence of the lactic ferments on the yield of butter. The average results are shown below:

Data for butter ripened with different starters.

	Number of analyses	Buttermilk	Lactic ferments: Quist	Lactic ferments: Blauenfeldt and Tvede	Lactic ferments: Zoffmann.	Lactic ferments: Hansen.
Per cent of fat in buttermilk	24	0.35	0.36	0.35	..	......
	8	0.38	0.35	0.37	0.35	0.36
Per cent of water in butter	21	14.68	14.58	14.78	.	......
	8	14.35	14.25	14.33	14.18	14.21
Relative yield of butter	48	100.00	100.20	99.60		
	6	100.00	100.30	100.10	100.10	(100.3)
	22	100.00	100.10	100.30	100.40	100.40

—F. W. WOLL.

The use of limewater for the determination of the acidity of cream, E. HOLM (*Syrnings forsog., Copenhagen, 1895, pp. 21–25*).—Limewater has been applied during late years for titrations of cream and buttermilk in the chemical laboratory of the Danish State experiment station, and its use in private creameries is recommended by the author. One part of quicklime is slaked with 50 parts of water, and the mixture violently shaken in a bottle. The water will dissolve slightly larger quantities of lime at a lower temperature than at higher temperatures, but between 11 and 18° C. the solubility changes only 3 per cent, a difference too small to be important in creamery work. The solution of lime is very nearly one twentieth normal. In making new solutions it is recommended to start from the beginning, rather than add water to the precipitate in the old solution.—F. W. WOLL.

The Babcock test as a basis for payment in cream gathering creameries, A. L. WINTON and A. W. OGDEN (*Connecticut State Sta. Rpt. 1894, pp. 214–244, pls. 2, figs. 5*).—This is a reprint from Bulletin 119 of the station (E. S. R., 6, p. 247), with some additions. Among the latter are an experiment showing the importance of thoroughly mixing cream before sampling, the records of 5 creameries in the State paying for milk on the basis of the fat test, and a comparison of the space system and the test system at 6 creameries. The monthly record of 5 creameries paying for milk on the test system shows that—

"While the average composition of the cream of all the patrons does not show very great fluctuations, from 16.9 to 19.8 per cent of fat, the cream of certain patrons on certain days has contained as little as 9.5 per cent of butter fat and of other patrons has contained 30 per cent. . . .

"The pounds of cream required to make a pound of butter has varied between 4.18 and 5.02 and has averaged 4.54 lbs. . . .

"The number of pounds of butter fat in the cream required to make a pound of finished butter varied between 0.807 and 0.877 pound and averaged 0.841 pound."

A study of butter made in Emilia, P. SPALLANZANI and A. PIZZI (*Staz. Sper. Agr. Ital., 28 (1895), No. 4, pp. 257–274, dgm. 1*).—Tabulated data give the iodin number and the specific gravity of 121 samples of butter made in Emilia between March 7, 1894, and March 7, 1895. From the results obtained the author concludes that a sample of butter which at 35° C. has a refraction number greater than 48, or a specific gravity at 100° C. less than 0.8640, is adulterated. The author regards as adulterated a sample of which the iodin number is less than 20. If in the period between May and September the iodin number ranges between 20 and 26, or in the other months between 20 and 23, the purity of the sample of butter made in Emilia may be suspected.

Dairying in Denmark during 1894, B. BÖGGILD (*Tidsskr. Landökon., 14 (1895), pp. 98–134*).—The annual report of the Danish State dairy counselor presents the usual retrospect of the past year, and contains much information of interest to the student of dairying. This being the tenth annual report by the author, he reviews the great changes that have taken place in Danish agriculture during the past decade.

From the tables given in the report we learn that Denmark exported 125,962,932 lbs. of butter during 1893–'94, 122,525,033 lbs. of which went to England. The excess exportation of butter amounted to 91 million pounds, against 79 million during the preceding year. The average price received for the butter in 1894 was 84.9 oere (22.9 cts.) per pound, against 93.9 oere (25.4 cts.) in 1893.

The export of bacon in 1894 amounted to 93.6 million pounds, against 84.1 million pounds in 1893. Great Britain imported 766,828 cwt. of bacon from Denmark in 1894, against 711,854 cwt. in 1893.—F. W. WOLL.

Conditions influencing the number and size of the fat globules in milk, PANKOWSKI (*Milch Ztg., 24 (1895), No. 24, p. 386*).

Shipment of milk in a frozen condition (*Tidsskr. Landm., 40 (1895), pp. 81, 85*).—The method described was devised and patented by a Swedish engineer, F. Casse, and has been adopted with very satisfactory results in shipping milk (and also cream) to London from Gothenburg in large pine barrels, weighing over 200 lbs. each and holding about 1,200 lbs.

The dairy—the art of handling milk, making butter, and the principal French and foreign cheeses, A. F. POURIAN (*La laiterie. Art de traiter de lait, de fabriquer le beurre et les principaux fromages français et étrangers. Paris: Audot, Lebroc et Cie, 5th ed.; abs. in Prog. Agr. et Vit., 12 (1895), No. 27, pp. 20–22*).

Remarks on Külling's viscometric method of examining butter, M. MANSFELD (*Ztschr. Nahr. Untersuch. und Hyg., 9 (1895), p. 135; abs. in Chem. Ztg., 19 (1895), No 44, Repert., p. 156*).

The unreliability of the creamometer for the estimation of fat in pasteurized milk, P. CAZENEUVE and E. HADDON (*Bul. Soc. Chim. Paris, 3d ser., 13–14 (1895), p. 500; abs. in Chem. Ztg., 19 (1895), No. 46, Repert., p. 166*).—The authors have found after a series of careful experiments that the creamometer is absolutely useless in estimating fat in pasteurized milk.—J. P. STREET.

The Babcock method of finding the amount of butter fat in milk and cream, A. L. WINTON and A. W. OGDEN (*Connecticut State Sta. Rpt. 1894, pp. 209–214, figs. 5*).—This is reprinted from Bulletin 117 of the station (E. S. R., 5, p. 689), with minor additions.

A coöperative dairy in Belgium, C. F. LODER-SYMONDS (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 369–373*).—Notes on the methods of butter making and on the rations fed.

C. Bolle's creamery in Berlin (*Tidsskr. Landtmän, 16 (1895), pp. 81–86, 128–130*).—Description, with illustrations, of a large milk supply house in Berlin receiving about 70,000 liters (over 150,000 pounds) of milk daily.

Soft cheese—Brie and Camembert, J. LONG (*Cult. and Country Gent., 1895, July 25, pp. 555, 556*).—A description of the methods of manufacturing these cheeses and of the plant or outfit required.

The principles of cheese making, J. LONG (*Cult. and Country Gent., 1895, July 4, pp. 507, 508*).—A popular article.

Dairying, J. W. HART (*South Carolina Sta. Bul. 19, pp. 65, figs. 26*).—Popular information, largely compiled, on the selection and breeding, feeding, and care of dairy cows, butter and cheese making, creameries and cheese factories, and fraudulent butter and cheese.

Report on the production of cheese and butter in Italy in 1893, DE CLERCQ (*Bul. Min. Agr. France, 14 (1895), No. 4, pp. 477–481*).

TECHNOLOGY.

Notes on the milling qualities of different varieties of wheat, F. B. GUTHRIE and E. H. GURNEY (*Agl. Gaz. N. S. W., 6 (1895), No. 3, pp. 159–180, dgm. 1, pl. 1*).—The methods employed in milling very small quantities of wheat, sometimes as little as 2 or 3 oz., are described in detail, as are also the methods of determining the weight per bushel of grain, the color, amount of gluten, and strength (or capacity for absorbing water) of flour, and of conducting baking tests. By comparing the flour made in the laboratory with that produced in the usual manner in the mills there was found to be close agreement between the two in gluten content, capacity for water, and color.

Tabulated data give for 75 varieties the appearance and weight per bushel of grain, percentage of flour, color of flour, percentage of gluten, total albuminoids, and soluble albuminoids in flour, nature and ash content of gluten, water absorbing capacity of flour, shrinkage in weight of dough during baking, and volume and appearance of loaf.

The following table gives the characteristics of the group of varieties:

Characteristics of the flour of varieties of wheat.

	Weight per bushel.	Ease of milling.	Color of flour	Gluten.	Strength.	Ash in gluten.	Soluble albuminoids.
Purple straw type.	Medium	Easy	Gray to pale yellow.	Very low	Weak	Medium	High.
Defiance type.	do	Easy to fair	Pale yellow	Low	Medium	Low	Uncertain.
Tuscan type	do	Easy	do	Medium	do	do	Very high.
Fife type	do	Fair	Yellow	High	Strong	Very low	Medium.
Indian type	Heavy	Easy	do	do	do	do	Do.
Poulard type	Light	Difficult	Yellow to brownish.	Medium	Weak	High	Uncertain.
Durum type.	Heavy	do	do	Very high	Medium	Very high	Low.

Two cross-bred varieties were found to possess characteristics intermediate between the parent varieties in color, gluten content, and water holding capacity of the flour, and ash content and character of gluten. Although only 2 samples were thus examined, the author concludes that the milling qualities of a cross bred wheat can be predicted with some degree of certainty from the corresponding characteristics of the parent varieties.

The following are among the conclusions reached:

"Ease of milling and good color of flour are generally found in those wheats which yield a flour deficient in gluten and strength.

"The wheats principally grown in New South Wales, and indeed in Australia, are those wheats with the above characteristics. These wheats are, moreover, as a rule, those that are liable to disease, and are in other respects not always desirable to the farmer.

"A very small concession in the matter of color (which is of relatively small importance) would permit of the cultivation of a far superior class of grain."

The analysis of sugar ash, WEICHMANN (*Sugar Cane, 27 (1895), p. 301*).

Differences between cane sugar and beet sugar, PHIPSON (*Sugar Cane, 27 (1895), p. 312; abs. in Chem Ztg., 19 (1895), No. 50, Repert., p. 187*).

Maple sugar (*Kew Misc. Bul. No. 102 and 103, pp. 127-129*).—Compiled notes on maple sugar production in the United States.

Report on the Danish sugar industry, DE COMMINES (*Bul. Min. Agr. France, 14 (1895), No. 4, pp. 471-474*).—This gives the prices received by the farmer for sugar beets and form of the ordinary contract between the beet grower and sugar manufacturer.

Bacteriological and chemical investigations on the souring of wine, I. GALEAZZI (*Staz. Sper Agr Ital, 28 (1895), No. 3, pp. 181-188, pl. 1*).

The artificial production of alcohol, G. GASTINE (*Prog. Agr. et Vit., 12 (1895), No. 27, pp. 14-16*).

Experiments with selected ferments, M. ZECCHINI and F. RAVIZZA (*Staz. Sper. Agr. Ital., 28 (1895), No 3, pp. 189-211*).

Studies on wine making in Algeria, L. ROOS (*Bul. Min. Agr. France, 14 (1895), No. 4, pp. 403-417, dgms. 3*).—Experiments on the influence of temperature.

Report on the castor oils in the Indian section of the Imperial Institute, London, W. H. DEERING and B. REDWOOD (*The Agl. Ledger, 1894, No. 17, pp. 5*).—Determinations of color, weight, viscosity, relation to polarized light, and other properties.

Analysis of oils, fats, and waxes, R. BENEDIKT, revised and enlarged by J. LEWKOWITSCH (*Macmillan & Co., London: 1895. Reviewed in Nature, 52 (1895), No. 1342, pp. 265, 266*).

The estimation and numerical expression of color in tanning materials, G. W. GRAY (*Jour. Soc. Chem. Ind., 14 (1895), No. 4, pp. 335, 336*).

AGRICULTURAL ENGINEERING.

Report on experiments made at the Experiment Station for Agricultural Implements, RINGLEMANN (*Bul. Min. Agr. France, 14 (1895), No. 4, pp. 418-456, figs. 19*).—Tests of many agricultural implements.

Kentucky highways, M. H. CRUMP (*U. S. Dept. Agr., Office of Road Inquiry Bul. 13, pp. 24*).—A history of the old and new systems of road building in Kentucky.

Good roads—extracts from messages of governors, R. STONE (*U. S. Dept. Agr., Office of Road Inquiry Bul. 14, pp. 24*).

Proceedings of the Good Roads Convention of Texas at Houston, February 19, 1895 (*U. S. Dept. Agr., Office of Road Inquiry Bul. 15, pp. 24*).

Employment of convicts in road building, R. STONE (*U. S. Dept. Agr., Office of Road Inquiry Bul. 16, pp. 15*).—"A compilation of various laws, treatises, and notes on the subject."

The lightning rod, a guide written especially for farmers, J. APPEL (*Lynafledderen, En Veiledning saerlig for Landmaend. Copenhagen: Roy. Agl. Soc. of Denmark, 1894, pp. 70*).

Silos and silo building, H. J. WATERS (*Pennsylvania Bd. Agr. Rpt. 1894, pp. 232–237, pls. 2*).

Clay industries of New York, H. RIES (*Bul. New York State Museum, 3 (1895), No 12, pp. 97–262*).—Properties of clays, and methods of manufacturing brick, drain tile, sewer pipe, flower pots, roofing tile, etc., are among the topics treated.

When to irrigate and how, J. M. IRWIN (*Home, Field, and Farm, 3 (1895), No. 6, p 92*).—Brief practical directions for irrigating field crops, fruits, and vegetables.

Irrigation in the Hawaiian Islands, G. MASON (*Irrigation Age, 8 (1895), No. 6, pp. 171–173*).

Irrigation by pumping in Kansas, C. C. HUTCHINSON (*Irrigation Age, 8 (1895), No. 6, p. 175*).

Agricultural machinery in Denmark during 1894, H. K. DENCKER (*Tidsskr. Landokon., 14 (1895), pp. 135–141*).

Cheapening and improvement of agricultural industries by means of steam power (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 22, pp. 315–317*).

STATISTICS.

Annual Report of Alabama College Station for 1894 (*Alabama College Sta. Rpt. 1894, pp. 22*).—Brief summaries of the work of the year by the heads of departments, and financial statement for the year ending June 30, 1894.

Annual Report of Arizona Station for 1894 (*Arizona Sta. Rpt. 1894, pp. 30–53*).—Reports by the director and heads of departments on the organization and work of the station, and a financial statement for the fiscal year ending June 30, 1894.

Report of board of control and of treasurer of Connecticut State Station (*Connecticut State Sta. Rpt. 1894, pp. XI, XII*).—A brief review of the work of the year, and financial report for the fiscal year ending September 30, 1894.

Annual Report of Idaho Station for 1894 (*Idaho Sta. Rpt. 1894, pp. 23*).—Brief reports on the organization and work of the station by the director and heads of departments, and treasurer's report for the fiscal year ending June 30, 1894.

Annual Report of Louisiana Stations for 1894 (*Louisiana Stas. Rpt. 1894, pp. 7*).—Brief notices by the director of work done at the different stations, and treasurer's report for the fiscal year ending June 30, 1894.

Annual Report of Massachusetts Hatch Station for 1894 (*Massachusetts Hatch Sta Rpt. 1894, pp. 25*).—Report on the organization and work of the station during the year, and financial statement for the fiscal year ending June 30, 1894.

Annual Report of Mississippi Station for 1894 (*Mississippi Sta. Rpt. 1894, pp. 4*).—Treasurer's report for the fiscal year ending June 30, 1894, and brief report by the director.

Report of treasurer and of station council of New Mexico Station for 1894 (*New Mexico Sta. Rpt. 1894, pp. 30, 43–50*).—This is for the fiscal year ending June 30, 1894, and presents the needs of the various departments of the station.

Biennial Report of North Carolina Station for 1893 and 1894 (*North Carolina Sta. Rpt. 1893, 1894, pp. 140*).—This includes a report on the fertilizer control, reports on the work and publications of the station, including a list of bulletins published, and short summaries by the heads of departments.

Annual Report of North Dakota Station for 1894 (*North Dakota Sta. Rpt. 1894, pp. 20*).—Report of director summarizing the work done during the year and financial statement for the fiscal year ending June 30, 1894.

Annual Report of Oregon Station for 1894 (*Oregon Sta. Rpt. 1894, pp. 19–33*).—Report of director, containing synopses of reports by heads of departments and financial statement for the fiscal year ending June 30, 1894.

Annual Report of Tennessee Station for 1894 (*Tennessee Sta. Rpt. 1894, pp. 15*).—This includes a brief account by the director of the organization of the station, a list of bulletins published, reports of heads of departments, and financial statement for the fiscal year ending June 30, 1894.

Report of director and of treasurer of Utah Station for 1893 (*Utah Sta. Rpt. 1893, pp. 6–9*).—Report of director and heads of departments on lines of work undertaken during the past year and treasurer's report for the fiscal year ending June 30, 1894.

Annual Report of Washington Station for 1894 (*Washington Sta. Rpt. 1894, pp. 5–18*).—Brief reports by director and heads of departments and financial statement for the fiscal year ending June 30, 1894.

Agricultural experiment stations in Holland, A. J. SWAVING (*Rijkslandbouwproefstations. Haarlem: H. D. T. Willink, 1895, pp. 16*).—Announcement of the establishment of three experiment stations—at Breda October 1, and Groningen and Hoorn November 1, 1889—and of the character of their work.

Report of the Statistician for June, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 127, n. s., pp. 231–284*).—The contents of this report are crop report for June, increase and decrease of acreage in cotton, temperature and rainfall report of European agent, notes on foreign agriculture, and transportation rates.

July crop report, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 128, July, 1895, pp. 28*).—Acreage and condition of growing crops in the different States, railway statistics, and transportation rates.

Production and price of cotton for one hundred years, J. L. WATKINS (*U. S. Dept. Agr., Division of Statistics Misc. Bul. 9, pp. 20*).—Notes and tabulated data giving important facts in the history of cotton and statistics of production, consumption, and price during the last 100 years.

Report of the Secretary of Agriculture for the year ending June 30, 1894 (*pp. 220*).—This differs from the reports of previous years in containing only the report of the Secretary and chiefs of bureaus, offices, and divisions regarding the administrative details of Department business. Popular accounts of the investigations carried on by the Department and their practical results, together with other information deemed of value to farmers, will be published in a separate volume called the Yearbook of the Department of Agriculture for 1894.

The world's markets for American products—German Empire (*U. S. Dept. Agr., Section of Foreign Markets Bul. 2, pp. 91*).—Among the most important topics treated are the following: Agriculture, forestry, fisheries, commerce, tariff, methods of stimulating the foreign trade of Germany, principal agricultural imports by countries, and consular reports bearing on the demand for American products.

The world's markets for American products—France (*U. S. Dept. Agr., Section of Foreign Markets Bul. 3, pp. 74*).—The topics treated are area and population; wealth and debt; agriculture; the wine industry; commerce; tariff; imports of agricultural products, animals, animal products, and other articles; and consular reports.

Farm bookkeeping, H. SCHROLL (*Om Landbrugsregnskab, dets form, Nytte og Betydning. Copenhagen: Roy. Agl. Soc. of Denmark, 1894, pp. 75*).

The monetary question, D. ZOLLA (*Ann. Agron., 21 (1895), No. 6, pp. 241–270, dgms. 4*).

Acts relating to agriculture in the Province of Ontario (*Ont. Dept. Agr. Warwick Bros. & Rutter, Toronto: 1895, pp. 461*).—The acts relating to agriculture passed by the provincial legislature.

NOTES.

ARIZONA UNIVERSITY AND STATION.—T. B. Comstock, president of the university and of the station council, has resigned from the university and Rev. Howard Billman, of Tucson, has been chosen to fill the vacancy.

CONNECTICUT STATE STATION.—The last general assembly increased the appropriation for this station from $8,000 to $10,000 annually and appropriated $2,500 for new buildings and permanent improvements. It also passed a pure food law, the enforcement of which is largely left to the station, and for which $2,500 is annually appropriated.

IDAHO STATION.—T. T. Rutledge has resigned as farm superintendent at the substation at Nampa. L. F. Henderson, station botanist, has been collecting the flora of the Salmon River country under the direction of the United States Department of Agriculture.

MICHIGAN COLLEGE AND STATION.—F. B. Mumford, assistant in agriculture, has resigned and H. W. Mumford has been elected to succeed him. A. T. Stevens, assistant in the farm department, has been succeeded by M. W. Fulton. A. B. Cordley has been appointed assistant in the department of horticulture, *vice* U. P. Hedrick, who becomes professor of horticulture at Corvallis, Oregon. W. L. Rossman has been appointed chemist of the Dairy and Food Commission and is succeeded as assistant chemist of the station by H. E. Harrison.

NEBRASKA STATION.—G. E. MacLean has been chosen director of the station.

NEW HAMPSHIRE COLLEGE AND STATION.—F. W. Rane has been elected professor of agriculture and horticulture, and will have charge of the college farm and the agricultural department of the station.

NORTH DAKOTA AGRICULTURAL COLLEGE.—J. H. Worst has been elected president of the college, *vice* J. B. Power, resigned. A new creamery is in course of erection which will be ready for operation by the middle of September. E. E. Kaufman, assistant in agriculture, has been elected professor of dairying.

PENNSYLVANIA COLLEGE AND STATION.—G. C. Watson, of New York Cornell Station, has been appointed professor of agriculture in the college and agriculturist of the station in place of H. J. Waters, who recently resigned to accept the directorship of the Missouri Experiment Station.

OKLAHOMA COLLEGE AND STATION.—At a meeting of the board of regents of the college held August 6 the following changes were made: G. E. Morrow was elected president of the college and director of the station, H. E. Glazier vice-director and horticulturist, and J. C. Neal botanist and entomologist.

UTAH STATION.—S. S. Twombly, consulting veterinarian, has severed his connection with the station and college and P. Fischer has been appointed to succeed him.

VIRGINIA STATION.—T. L. Watson has resigned as assistant chemist and A. T. Eskridge and W. B. Ellett have been appointed assistant chemists.

EXPERIMENT STATION RECORD.

VOL. VII. NO. 4.

Soil investigations have by no means received such attention from our stations as their importance demands. Much of the field work of the stations must necessarily give comparatively imperfect and valueless results, because it is not accompanied by studies of the soils experimented with. It is very unfortunate that stations which have for a number of years been carrying on field experiments with a great variety of crops have no records regarding the chemical and physical conditions of the soils when the experiments were begun, nor the changes which have taken place in the soils during the progress of the experiments. It is hoped that the renewed interest in soil investigations, which seems to have been recently excited, may lead many stations to begin serious studies on this line. The area devoted to field experiments may well be contracted if this is necessary in order to afford opportunity for more thorough study of the soil.

At the recent convention of the Association of Official Agricultural Chemists, which is briefly reported in this number of the Record, there was evidence, as in past years, of a lack of enthusiastic coöperation in the testing of methods. This must cause genuine regret to all who are interested in the advancement of agricultural chemistry, and must be a matter of surprise, occurring as it does among the members of an association organized solely for the purpose of testing and perfecting analytical methods. The papers of the different reporters show that a comparatively small proportion of the members take part in the study of the various methods. As a consequence, new and worthless methods are likely to be adopted unadvisedly, or the adoption of desirable methods unnecessarily delayed. The latter is more likely to be the case, owing to a recent amendment to the constitution, which prevents the precipitate adoption of new methods or ill-considered modifications of old, well-proven methods.

While more active coöperation of all members of the Association in its work is so much to be desired, it is equally important that more individual effort be directed toward devising and perfecting necessary methods in certain lines. As a result of such effort the Association had laid before it at its recent convention, well tested in all of its details, a volumetric method for determining phosphoric acid which effects a

great saving in time and expense and which is probably fully the equal of present standard methods in accuracy. The investigations of an individual chemist also pointed out a probable source of serious error in the methods for determining potash, and indicated the means of avoiding it. Such work redounds not only to the credit of the individual performing it, but, what is probably of greater importance, it demonstrates the vitality and effectiveness of the Association.

For the first time in the history of the Association a thorough editing and revision of its methods was provided for. It is extremely unfortunate that adequate provision has not been made from the beginning for putting into the best possible form the methods of analysis adopted by over nine-tenths of the official chemists of this country in actual practice and accepted by the rest of the scientific world as the finished product of the leading agricultural chemists of the United States.

In the appointment of the abstract committee of the Association the number was increased to nine members. The committee consists of Messrs. E. W. Allen, J. L. Beeson, W. D. Bigelow, B. W. Kilgore, W. H. Krug, C. L. Parsons, H. J. Patterson, A. M. Peter, and F. W. Woll. This committee is charged with the preparation of abstracts and lists of papers appearing in current periodicals on analytical methods and apparatus for fertilizers, feeding stuffs, dairy products, soils, sugar, fermented and distilled liquors, and tannin, this representing the present scope of the Association. The work of this committee should be one of the most useful features of the Association in providing a means for keeping abreast with the work on methods in the several lines. In order to bring the abstracts more promptly to the notice of members of the Association, their periodical publication in the Record was commenced last year. The work of the committee for 1895-'96 has been organized and the publication of its abstracts will begin in the next number of the Record. In view of the increase in the number of abstractors it is hoped that the work of this committee will be even more profitable than heretofore.

CONVENTION OF ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, 1895.

The twelfth annual convention of the Association of Official Agricultural Chemists was held in the lecture room of the National Museum at Washington, D. C., September 5-7, H. A. Huston presiding. Seventy chemists were in attendance.

A committee consisting of R. C. Kedzie and W. C. Stubbs was appointed to wait upon the Secretary and Assistant Secretary of Agriculture and invite them to take part in the proceedings of the convention. The Secretary appeared before the convention and delivered a short address, in which he called attention to the need of educating the farmer to meet the intense competition in the markets of the world and spoke of the value of the various agricultural institutions for this purpose. A brief address was also delivered before the Association by ex-Assistant Secretary Willits.

The president, in his annual address, pointed out the desirability of fuller discussion of papers presented before the Association, and advised some action by the convention with reference to amendment or interpretation of the portions of the constitution relating to the sending out of samples, reagents, and report blanks by reporters; the choice of a place of meeting; and changes in methods. He also proposed that descriptions accompany samples of fertilizers sent out by the different reporters, and called attention to the need of methods for distinguishing between available phosphoric acid of superphosphates and non acidulated materials, and of investigation of methods of analysis of human foods.

The following committee on recommendations of reporters was appointed: J. B. Lindsey, H. J. Wheeler, H. J. Patterson, A. M. Peter, and B. B. Ross.

Fertilizers.—(1) *Potash.*—The report on potash was submitted by H. J. Wheeler, and summarized the results of studies by 11 analysts, including 1 Norwegian chemist, of the influence of the presence of different impurities (tricalcium phosphate, sulphuric acid, magnesium chlorid, and cane sugar) upon the accuracy of present official methods; and of the sources of error in these methods pointed out by N. Robinson[1] and Breyer and Schweitzer.[2]

The results indicate the reliability, under proper manipulation, of both the Lindo-Gladding and alternate methods for the purposes of fertilizer analysis, even in presence of large amounts of impurities.

A. L. Winton described 2 classes of crystals of potassio platinic chlorid—one comprising pulverulent compound crystals, the other

[1] Jour. Amer. Chem. Soc., 16 (1894), No. 6, p. 364 (E. S. R., 6, p. 105).

[2] Chem. Ztg., 1892, p. 1720 (E. S. R., 4, p. 584).

granular octohedral crystals. He found that while the latter were completely dried without special difficulty at the temperature of boiling water, the former required continued heating at elevated temperatures sometimes as high as 160° C. He had further observed that the smaller crystals were usually formed in abundance when the solution of the potash salt, to which the platinic chlorid was added, was sufficiently concentrated to give an immediate precipitate. On the other hand, when the solution was so dilute that no immediate precipitation occurred, the larger crystals usually predominated in the salt obtained.[1] He recommended investigations with reference to the establishment of a new factor for calculating potash from the potassio-platinic chlorid.

The principal changes in the methods for potash consisted in inserting directions in the proper places for diluting the final solution of potassium chlorid so that no immediate precipitate will appear on the addition of platinic chlorid; for washing the potassio-platinic chlorid with 80 per cent alcohol (by volume); and for drying the salt finally obtained at over 100° C. The subject of the change of factor was referred to the reporters for next year.

(2) *Phosphoric acid.*—B. W. Kilgore reported the results of tests by 14 analysts, including 1 Norwegian chemist, of the molybdic and citrate methods of determining phosphoric acid. A large amount of data was presented which tended to confirm the substantial accuracy of the molybdic method, but was inconclusive as to the citrate method. The reporter also gave results of tests of the volumetric method of Pemberton, modified by himself, which indicated that this method is both rapid and accurate and may probably be adopted with advantage as an official method. The results obtained by this method were as a rule lower than those obtained with the official molybdic method, but the indications were that they were nearer the truth than the results by the latter method.

In the discussion which followed the reading of this report, H. A. Huston called attention to the importance of having complete data regarding the composition of samples of phosphate distributed by the reporter to the various analysts.

H. J. Wheeler suggested that discrepancies in the results obtained by different analysts in the determination of insoluble phosphoric acid might be explained by changes which go on in samples of phosphate on standing, and that probably the results would be more concordant if the determinations of soluble and reverted phosphoric acid could all be made on the same date.

A paper on the citrate method of phosphoric acid determination, with special reference to insoluble phosphates, was presented by F. Bergami. The author stated that while the citrate method in the extremely simple form used for the tests reported will not give absolutely correct results, "still as long as it can be proven that with

[1] Jour. Amer. Chem. Soc., 17 (1895), No. 6, p. 453 (E. S. R., 7, p. 88).

ordinary care the errors can be kept inside of limits which allow the use of the method for nearly all practical purposes" he did not "see any reason why the same should not be given a place alongside of the molybdic method."

B. B. Ross reported the results of comparisons of the direct and difference method for reverted phosphoric acid. The direct method has given good results in his laboratory, but has not proved altogether satisfactory in the hands of other chemists.

H. A. Huston stated that it was almost impossible to obtain chemically pure phosphates for check tests. The phosphates of silver and of zinc were apparently the purest with which he had experimented. He reported that he was endeavoring to work out a volumetric method, using sulphuric acid throughout instead of nitric acid. He displayed a number of charts showing the influence of variation in the amount of solvent, temperature, etc., on the amount of citrate-soluble phosphoric acid.

B. B. Ross displayed a model of a mechanical stirrer driven by an electric motor for use in determining phosphoric acid, stating that it had been successfully employed in his laboratory.

Very slight changes, chiefly of a verbal character, were made in the methods for phosphoric acid, the principal modification being a provision for the washing of the final precipitate with 2½ per cent of ammonia until free of chlorids, and igniting the precipitate until white or grayish white before weighing. It was directed that Kilgore's volumetric method be published, and that the various chemists be given an opportunity to test it during the coming year with a view to its adoption at the next convention of the Association. The reporters were also requested to further investigate the citrate method of phosphoric acid determination.

(3) *Nitrogen.*—A report of tests by 11 chemists of the official and Fassbender methods for total nitrogen and of the Ulsch and zinc-iron methods for nitric nitrogen was presented by J. M. Bartlett. With very few exceptions the results were concordant and furnish strong evidence of the reliability of the methods.

In the discussion following the report J. B. Lindsey stated that an error may be introduced into the Ulsch method by not using enough magnesium oxid and not distilling long enough. He also spoke of the difficulty of preventing alkali from being carried over into the distillate in the zinc-iron method.

H. C Sherman presented a paper on the determination of nitric nitrogen, in which he reported results highly favorable to the Ulsch method.

A paper by S. H. T. Hays, on the availability of nitrogen in mixed fertilizers, was read, giving at some length the results of tests of pepsin digestion, putrefaction, and distillation with permanganate of potash as in water analysis. The last method appeared to give the most promising results.

The Ulsch, Fassbender, and zinc-iron methods were referred to the reporters for further investigations. The only action taken with regard to the methods for nitrogen was the addition of the method of distillation with magnesium oxid for determining ammonia.

Soils and ash.—The report on this subject was presented by A. M. Peter. This report gave data of chemical analyses of the ash of corn stover and of mechanical and chemical analyses by 14 chemists of samples of soil of known history, especial attention being given to methods of determining the availability of plant food in the soil. The latter included digestion of the soil in 1 per cent citric acid for 5 hours with frequent thorough shaking; digestion for the same length of time in a solution of 6.3 gm. of oxalic acid in 1 liter of water; and digestion in the same manner in a solution containing 20 gm. of crystallized oxalate of ammonia and 2.15 gm. of anhydrous acetic acid. Goss's method, as well as present official methods for determining the amount of soil constituents soluble in strong acids, were also tested. Goss's method gave as a rule more satisfactory results than the ordinary methods, and it was adopted by the convention as an optional method of soil analysis.

The results obtained in digestion with the weak acids were of such a character as to encourage the hope that a method may be developed along this line which will be fairly indicative of the actual conditions of soil fertility. A few changes of minor importance only were made in the methods of soil analysis.

A. Goss read a paper reporting the results of determinations of phosphoric acid and potash in soils, including studies of methods of preparing soil solutions and of quick precipitation of phosphoric acid at high temperatures. The data obtained in examinations of a number of different soils indicated that 1 hour's digestion with sulphuric acid, with the addition of mercuric oxid, gives the maximum solvent effect; and that 15 minutes at 80° C. is sufficient to precipitate all phosphoric acid from the soil solution.

H. J. Wheeler read a paper on the necessity for tests for acidity on upland or naturally well-drained soils, in which he called attention to the fact that well-drained soils which are unproductive on account of an excess of acidity are widely distributed and that lime is the corrective of this condition.

B. W. Kilgore reported the results obtained by himself and C. B. Williams in the determination of phosphoric acid in soils by double precipitation with molybdic solution (1) at 40° C. in a water bath with 30 cc. of official molybdic solution, and (2) at 75° C. in a water bath with concentrated nitric acid and 2 cc. of molybdic solution, the phospho-molybdate being titrated with standard alkali.

A paper by H. Snyder on the determination of total insoluble matter, phosphoric acid, lime, and potash in soils, which described in detail methods used by the author in soil analysis, was read by A. M. Peter, as well as a paper by H. Snyder and J. Thompson on the effect of the

presence of a small amount of nitric acid in the acid digestion of soils, which showed that the addition of a few drops of this acid resulted in a slight but constant increase in the amount of matter dissolved.

A paper by E. W. Hilgard on the recognition of "nitrogen hungriness" in soils was read by H. W. Wiley, which discussed present methods of determining the humus in soils as well as investigations of the nitrogen content of humus, the conclusion being drawn that soils containing humus in which the percentage of nitrogen was less than 2.5 are likely to need applications of nitrogenous fertilizers regardless of the total amount of nitrogen present.

M. Whitney discussed the importance of physical examination of soils. W. C. Stubbs called attention to the importance of the study of the physical properties of soils, especially on soils such as those occurring in some parts of Louisiana where fertilizer experiments have been practically barren of results. W. G. Brown questioned the utility of soil analysis as at present conducted.

Sugar.—E. E. Ewell reported on tests of methods of sugar analysis, especial attention having been given to the determination of moisture. Drying on pumice stone gave good results, but, as shown by R. C. Kedzie, the results vary with the amount of sample taken.

Numerous and extensive changes, many, however, of a verbal character, in methods of sugar analysis were recommended, and the recommendations of the reporter were adopted as a whole, the methods of sugar analysis being referred to the reporter and the secretary of the Association to be rewritten.

A paper giving the results of determinations of moisture in viscous organic solutions by drying on pumice stone, by O. Carr and T. F. Sanborn, was read.

Fermented and distilled liquors.—W. D. Bigelow reported on tests of methods for fermented and distilled liquors by 11 analysts. The principal change in method recommended was the discontinuance of the use of the mercury valve in the distilling apparatus and the determination and the subtraction of the ash in the method for glycerol. The rewriting of several paragraphs of the present methods was directed.

Feeding stuffs.—The report on this subject was submitted by H. J. Patterson. Attention was devoted during the past year principally to methods for crude fiber and for determining the constituents of nitrogen-free extract—dextrose, sucrose, starch, and pentosans. Sachsse's, Märcker's, and Stone's methods for starch were studied. Six analysts, including 2 foreign chemists, furnished reports, but in some cases these were only partial or contained results obtained by methods not originally outlined by the reporter. The data obtained in different laboratories were very discordant and generally unsatisfactory. It was decided that the present methods remain unaltered; that methods for dextrose and sucrose be further investigated; and that Sachsse's method for starch be official only for potatoes. Tollens and Flint's method for pentosans as modified by Krug is to be studied during the coming year,

J. B. Lindsey pointed out that little progress has been made in the improvements of methods of analysis of feeding stuffs and advocated abandonment of the attempt to improve the method for crude fiber, believing it better to attempt the separation of the various constituents of crude fiber along the same line as that followed in the study of nitrogen-free extract.

H. A. Huston reported briefly the results of a comparison of the action of various solvents on hay with the action of the digestive fluids of the animal.

A. S. Mitchell recommended that a committee be appointed to investigate the extent of adulteration of foods and the means taken to prevent it in different States with a view to formulating legislation on the subject. The recommendation was adopted by the Association, and a committee was appointed to investigate this subject and report at the next convention.

Dairy products.—No formal report on this subject was submitted. H. W. Wiley read a paper prepared by S. M. Babcock, discussing formulas for calculating solids not fat in milk, and by C. G. Hopkins and W. A. Powers on the determination of the acidity of milk and cream. The method proposed for the latter purpose was as follows: Dilute 25 cc. of milk to 250 cc. with boiling water, boil 1 to 2 minutes, add 2 cc. of 1 per cent phenolphthalein, and titrate with standard alkali.

Tannin.—W. H. Krug reported the results of comparisons by 8 chemists of the methods of determining the tanning power of a tannin extract. These results showed that the present hide powder method is unreliable. The mercuric oxid method is recommended for investigation during the coming year.

Report of committee on editing methods.—The committee on editing methods reported in detail a comprehensive and consistent plan of revision of methods.

Report of abstract committee.—A brief verbal report from the abstract committee was submitted by W. Frear, outlining the work accomplished by this committee and recommending current reports of abstracts.

Officers of the Association.—The officers of the Association elected for the coming year were as follows: President, B. B. Ross; vice-president, W. Frear; secretary, H. W. Wiley; executive committee, H. J. Wheeler and F. W. Traphagen.

The associate reporters in each case were advanced to the position of reporters, and the following associates were appointed: Phosphoric acid, L. H. Merrill; nitrogen, R. J. Davidson; potash, W. L. Hutchinson; soils and ash, W. G. Brown; dairy products, C. L. Penny; foods and feeding stuffs, F. W. Morse; fermented liquors, W. C. Blaisdell; sugar, L. W. Wilkinson; tannin, B. D. Westenfelder.

The abstract committee is as follows: E. W. Allen, chairman; C. L. Parsons, W. D. Bigelow, A. M. Peter, H. J. Patterson, W. H. Krug, B. W. Kilgore, F. W. Woll, and J. L. Beeson.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

On the chemical determination of the agricultural value of phosphatic fertilizers, G. PATUREL (*Ann. Agron., 21 (1895), No. 7, pp. 325–342*).—This is the second paper by the author on this subject and reports results of determinations of solubility in 1 per cent citric acid of the phosphoric acid in various natural phosphates, including apatite, Somme phosphate, Navassa phosphate, coprolites, etc., and in such commercial products as bone ash, phosphatic slag, and precipitated phosphate. For purposes of comparison the results obtained by Grandeau, Petermann, and others in culture experiments with some of these phosphates are briefly summarized.

The conclusion is reached that the assimilability of the different phosphates by plants may be accurately measured by treatment with citric acid in the following manner: One gram of the finely ground phosphate is placed in a flask and 500 cc. of a solution containing 5 gm. of crystallized citric acid is added. After 24 hours, during which the mixture is shaken as frequently as possible, a portion of the solution is filtered off and phosphoric acid determined. At the same time a determination of total phosphoric acid is made. In case of phosphatic slags the citric acid solution is added little by little and allowed to filter through the finely powdered slag in order to remove at the beginning the larger part of free lime and silicate of lime.

On the determination of nitric nitrogen in presence of organic nitrogen, T. PFEIFFER and H. THURMANN (*Landw. Vers. Stat., 46 (1895), pp. 1–20; abs. in Jour. Chem. Soc. London, 1895, Sept., p. 369; and Chem. Ztg., 19 (1895), No. 62, Repert., p. 211*).—Schlössing's method (reduction with ferrous chlorid) and the method of reduction with zinc dust in alkaline solution gave unsatisfactory results when tested on samples of manure or urine to which known amounts of nitric nitrogen had been added. The method finally adopted after numerous experiments was as follows: To the solution[1] in a Lintner pressure flask add about 10 gm. of caustic soda and heat at 120 to 130° C. for about 8 hours. Allow the contents of the flask to cool and decant the solution into a distilling flask, the solid residue being washed on a filter and dried. Add a further quantity of soda to the solution and boil until no more ammonia

[1] Fifty cubic centimeters of solution was used in the test reported.

is evolved. The dried residue is then washed from the filter paper in the flask with acetic acid and water, and the whole reduced with zinc iron in the usual manner. Ammonia in barnyard manure and similar substances may generally be accurately estimated by simply distilling with magnesia.

The following method for preparing samples of manure for analysis is given: The manure is sifted in peat powder, 15 to 20 per cent, quickly mixed and dried after addition of acid. An odorless mixture which is readily sampled is thus obtained. The exact amount of peat, as well as its composition, must of course be known.

On the causes of the coloration and the coagulation of milk by heat; formation of formic acid at the expense of the lactose, P. CAZENEUVE and E. HADDON (*Jour. Pharm. et Chim., 6 ser., 15 (1895), No. 2, pp. 51–57; Bul. Soc. Chim. Paris, 13–14 (1895), No. 14, pp. 737–740*).—The results of a number of experiments in heating milk to different temperatures and determining the changes which resulted from this treatment indicated that the coloration of milk by heat was due to the oxidation of the lactose in the presence of the alkaline salts of the milk, and that the lactose as a result of this oxidation furnished various acids, among which formic acid was readily detected in amounts sufficient to explain the coagulation of the milk. The coagulated casein was not altered, but simply colored brown by the compounds formed from the lactose.

Estimation of water in silicates, P. JANNASCH and P. WEINGARTEN (*Ztschr. anorgan. Chem., 8 (1895), pp. 352–355; abs. in Jour. Chem. Soc. London, 1895, Aug., p. 325*).—"The method consists in heating the finely powdered silicate mixture with dry borax in a tube of hard glass and passing over it a current of dry air. If the silicate contains fluorin the gases are passed through a column of dry lead chromate before absorbing the water. The combustion tube is bent in the center so as to form a receiver about 7 cm. long, in which the mixture of silicate and borax is heated so that the outlet for the gases is restricted. The tube charged with borax is heated in a muffle at 270 and 280° C. for half an hour, a current of dry air being passed through it at the same time. It is then allowed to cool slowly and the silicate introduced and mixed with the borax. The mixture is then heated until all the water is expelled, the water being collected in a calcium chlorid tube."

The American Chemical Society (*Science, n. ser., 2 (1895), No. 37, pp. 337, 338*).—A brief report is given of the eleventh general meeting held at Springfield, Massachusetts, August 27 and 28

Justus von Liebig, his life and work, W. A. SHENSTONE (*New York: Macmillan & Co., pp. 219; reviewed in Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 833, 834*).

How far shall the periodic law be followed in teaching chemistry, F. P. VENABLE (*Science, n. ser., 2 (1895), No. 42, pp. 506–509*).

Bibliography as a feature of the chemical curriculum, H. C. BOLTON (*Science, n. ser., 2 (1895), No. 40, pp. 440–442*).—Read before the section on chemistry at the convention of the American Association for the Advancement of Science, August, 1895.

Schools of chemistry in Great Britain (*Chem. News, 72 (1895), No. 1867, pp. 111–126*).

Agricultural chemistry, H. W. WILEY (*Science, n. ser., 2 (1895), No. 40, pp. 442–445*).—Read before the section on chemistry at the convention of the American Association for the Advancement of Science, September 3, 1895.

Analytical chemistry, N. MENSCHUTKIN (*London and New York: Macmillan & Co., pp. 512; translation by J. Locke*).

The annual convention of the Free Union of Bavarian Representatives of Applied Chemistry in Baireuth, August 2 and 3, 1895 (*Chem. Ztg., 19 (1895), No. 64, pp. 1451–1453*).

Poisons, their effects and detection, A. W. BLYTH (*London: Charles Griffin & Co. (Limited), 1895, 3d ed., pp. 724*).—In this edition this well-known work has undergone such enlargements and additions that it may be considered a new publication.

Address of the president of the chemical section of the British Association for the Advancement of Science (*Chem. News, 72 (1895), Nos. 1869, pp. 141–148; 1870, pp. 151, 152*).

Preparation of sulphuric acid in ammonium sulphate factories, W. STEVENSON (*Gas World, 1895, p. 705; abs. in Chem. Ztg., 19 (1895), No. 70, Repert., p. 192*).

Chemical studies on copper compounds little used as fungicides, L. SOSTEGNI (*Staz. Sper. Agr. Ital., 28 (1895), No. 5, pp. 441–467*).

On the chemistry of nitrogen; the rapidity of the formation of amin and alkyl ammonium salts, N. MENSCHUTKIN (*Ber. deut. chem. Ges., 28 (1895), No. 11, pp. 1398–1407*).

On some alkaline phosphates, C. HUGOT (*Compt. Rend., 121 (1895), No. 4, pp. 206–208*).

The effect of an addition of alum on the chemical composition of wine, F. SESTINI (*Staz. Sper. Agr. Ital., 28 (1895), No. 5, pp. 281–286*).

On the estimation of phosphoric acid in wine, R. WIRTH (*Chem. Ztg., 19 (1895), No. 79, p. 1786*).

On the constitution of the vegetable albuminoids, L. FLOURENS (*Compt. Rend., 121 (1895), No. 4, pp. 216–219*).

Concerning phycocyan, a crystallizable albuminoid substance, H. MALISCH (*Bot. Ztg., 53 (1895), No. 6, pp. 131–135*).

The rotatory power of maltose, H. OST (*Chem. Ztg., 19 (1895), No. 77, p. 1727*).

Note on the gravimetric determination of maltose by Fehling's solution, T. A. GLENDINNING (*Jour. Chem. Soc. London, 1895, Oct., pp. 999–1000*).

On isomaltose, C. ULRICH (*Chem. Ztg., 19 (1895), No. 68, pp. 1523, 1524*).

A characteristic reaction of saccharose, G. PAPASOGLI (*Staz. Sper. Agr. Ital., 28 (1895), No. 5, pp. 313–316*).

On the reducing substances contained in the sugar cane, DE BEAUFRET (*Sugar Cane, 1895, Oct., pp. 524–528*).

The sugar of Agave americana, W. E. STONE and D. LOTZ (*Amer. Chem. Jour., 17 (1895), p. 368; abs. in Chem. Ztg., 19 (1895), No. 70, Repert., p. 181*).—The sugar first obtained by G. Michaud and J. T. Tristanos from this source was found by the authors to be sucrose.

Studies on starch, H. OST (*Chem. Ztg., 19 (1895), No. 67, pp. 1501–1507*).

On cellulose, E. SCHULZE (*Chem. Ztg., 19 (1895), No. 66, pp. 1465–1467*).

On the action of fuming nitric acid on xylose and arabinose, R. BADER (*Chem. Ztg., 19 (1895), No. 82, p. 1851*).

Ammonium phospho-molybdate and the reducing action of zinc in the reductor, A. A. BLAIR and J. E. WHITFIELD (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 747–760, fig. 1*).

On the presence of alumina in plants and on its separation, BERTHELOT and G. ANDRÉ (*Ann. Chim. et Phys., 1895, July, pp. 429–432*).

The precipitation and gravimetric determination of carbon dioxid, F. A. GOOCH and J. K. PHELPS (*Amer. Jour. Sci., 1 (1895); abs. in Chem. News, 72 (1895), No. 1873, pp. 194, 195, fig. 1*).

Estimation of iodin in organic substances, M. C. SCHUYTEN (*Chem. Ztg., 19 (1895), No. 49, p. 1143*).

Estimation of iron and aluminum in phosphates, F. JEAN (*Jour. Pharm., ser. 6, 1 (1895), pp. 99–101*).

A new method for the quantitative determination of starch, DENNSTEDT and VOIGTLÄNDER (*Forsch. Lebensmtl. Hyg. Chem., 2 (1895), p 173; abs. in Chem. Ztg., 19 (1895), No. 62, Repert., p. 214*).

Investigations on the behavior of sugars toward alkaline copper solutions (*Jour. Kgl. Karlsberg Laborat., Meddelelsen, 4 (1895); abs. in Chem. Ztg., 19 (1895), No. 64, Repert., p. 218*).

The determination of sugar by means of ammoniacal copper solution, Z. PESKA (*Ztschr. Böhmen, 19, p. 373; abs. in Ztschr. angew. Chem., 1895, No. 18, p. 550; and Analyst, 20 (1895), No. 235, p. 230*).

Levulose and its humus derivatives, B. RAYMAN and O. SULC (*Ztschr. Böhmen, 19, p. 765; Rozpravy ceské akademie, 4 (1895), 11, No. 4; abs. in Ztschr. angew. Chem., 1895, No. 18, p. 551; and Chem. Ztg., 19 (1895), No. 76, Repert , p. 271*).

Estimation of nitrogen in fertilizers containing nitrates, V. EVANS (*Chem. News, 71 (1895), p. 307; abs. in Chem. Ztg., 19 (1895), No. 62, Repert., p. 214*).

The volumetric determination of chloro-platinates, estimation of potash, etc., L. L. DE KONINCK (*Chem. Ztg., 19 (1895), No. 61, p. 1383*).—Additional notes on previous work by the author (*Chem. Ztg., 19 (1895), p. 901*), and by H. Foerster (*Ber. deut. chem. Ges., 19 (1895), p. 568*).

Note on the formation of platinic pyrophosphate, R. E. BARNETT (*Jour. Chem. Soc. London, 1895, June, pp. 513, 514*).

Manganese ammonium phosphate and its use in the volumetric determination of phosphoric acid, LINDEMAN and MOTIEU (*Bul. Soc. Chim. Paris, 13–14 (1895), p. 523; abs. in Chem. Ztg., 19 (1895), No 48, Repert., p. 176*).

Note on the determination of alkaline salts in fertilizers, A. CAMERON (*Jour. Soc. Chem. Ind., 1895, May, p. 427; abs. in Bul. Soc. Chim. Paris, 13–14 (1895), No. 16–17, pp. 1081, 1082*).

On the reduction of oxid of nitrogen by moist iron or zinc, P. SABATIER and J. B. SENDERENS (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 16–17, pp. 790–794*).

The reduction of oxid of nitrogen by metals in the presence of water, P. SABATIER and J. B. SENDERENS (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 16–17, pp. 794–798*).

On the production of citric acid from cane sugar, T. L. PHIPSON (*Chem. News, 72 (1895), No. 1866, p. 100*).

Determination of acetic acid in vinegar (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, p. 831*).

On the determination of alcohol, II, E. DUCLAUX (*Ann. Inst. Pasteur, 9 (1895), No. 7, pp. 575–588, figs. 2*).

Acidimetric estimation of vegetable alkaloids, a study of indicators, L. F. KEBLER (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 822–831*).

Contributions to the analysis of fatty substances, G. HALPHEN (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 13, pp. 703–715*).

A modification of the Soxhlet extraction apparatus for use at the boiling temperature, A. PHILIPS (*Ber. deut. chem. Ges., 28 (1895), No. 12, p. 1475; abs. in Chem. Ztg., 19 (1895), No. 68, Repert., p. 233, fig. 1*).

A new lactobutyrometer, A. LONGI (*Gazz. chim. Ital., 25 (1895), p. 44; abs. in Chem. Ztg., 19 (1895), No. 68, Repert., p. 240, fig. 1*).

Investigation of butter and margarin by means of Pulrich's refractometer, J. W. MOBERGER and J. W. HAMNER (*Nord. pharm. Tidsskr., 2 (1895), p. 243; abs. in Chem. Ztg., 19 (1895), No. 68, Repert., p. 240*).

The Brullé method for margarin, DU ROI (*Molk. Ztg., 9 (1895), No. 33, p. 502*).

A contribution to butter analysis, J. SAMELSON (*Chem. Ztg., 19 (1895), No. 73, p. 1626*).

A butter refractometer, C. ZEISS (*Pharm. Centbl., 1895, p. 433; abs. in Ztschr. angew. Chem., 1895, No. 18, p. 556*).

On the determination of water in raw sugars, J. W. GUNNING (*Neue Ztschr. Rubenz. Ind., 35 (1895), No. 14, pp. 142–145*).

Determination of the fatty acids of butter soluble in water containing sulphuric acid, A. ZEGA (*Chem. Ztg., 19 (1895), No. 23, p. 504*).

Examination of fat and margarin cheese, M. KÜHN (*Chem. Ztg., 19 (1895), Nos. 25, p. 554; 27, pp. 601, 602; 29, pp. 648, 649*).

The use of the Abbé-Zeiss refractometer in butter analysis, J. DELAITE (*Ind. Lait., 20 (1895), Nos. 28, p. 218; 29, pp. 225, 226*).

On the Hübl iodin-addition method and suggestions as to its improvement, R. WALLER (*Chem. Ztg., 19 (1895), Nos. 79, pp. 1786, 1787; 81, pp. 1831, 1832*).

On the determination of the specific gravity of curdled milk (*Chem. Ztg., 19 (1895), No. 65, p. 1468*).

The detection of cotton oil in American lard, J. DUPONT (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 15, pp. 775–780*).

Report on the methods of detecting adulterations in olive oil, II, A. MÜNTZ, C. DURAND, and E. MILLIAU (*Bul. Min. Agr. France, 14 (1895), No. 2, pp. 139–165*).

Titration with lime water, E. HOLM (*Nord. pharm. Tidsskr., 2 (1895), p. 447; abs. in Chem. Ztg., 19 (1895), No. 64, Repert., p. 217*).

Methods of water analysis, C. L. KENNICOTT (*Rpt. Dept. Health Chicago, 1894, pp. 169–176, figs. 2*).—The methods used in the laboratory of the department of health for determining the sanitary quality of water are described in detail, and some of the apparatus employed is illustrated.

Analyses of ores and minerals, M. B. HARDIN (*South Carolina Sta. Rpt. 1894, pp. 23–27*).—The results of examinations of 69 samples are reported.

On a new extraction apparatus, L. L. DE KONINCK (*Chem. Ztg., 19 (1895), No. 74, p. 1657, fig. 1*).

A water suction and blast pump, O. ZOTH (*Ztschr. Instrumentenk., 15 (1895), p. 232; abs. in Chem. Ztg., 19 (1895), No. 56, Repert., p. 197, fig. 1*).

New shaking and stirring apparatus, E. SAUER (*Ztschr. angew. Chem., 1895, No. 18, p. 545, fig. 1*).

A new generator, E. P. HARRIS (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 809, 810, figs. 2*).

A new valve pipette, O BOCK (*Ztschr. analyt. Chem., 34 (1895), No. 4, pp. 432, 433, fig. 1*).

A short thermometer with the long scale, P. N. RAIKOW (*Chem. Ztg., 19 (1895), No. 79, p. 1788, figs. 5*).—This is a patented instrument, and consists of a mercury bulb with a spiral or zigzag capillary stem inclosed in a glass tube.

The thermophone, a new instrument for determining temperatures, H. E. WARREN and G. C. WHIPPLE (*Tech. Quart., 8 (1895), No. 2, pp. 125–152, figs. 11, pls. 3*).—An electrical instrument "for measuring temperature, particularly the temperature of a distant or inaccessible place," designed by the authors in 1894, is described in detail, and results obtained by its use are reported.

A simple thermostat for fermentation, physiological and bacterial work as well as for seed testing, A. STUTZER and R. BURRI (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 17, pp. 625–627*).

BOTANY.

Notes on experiments in cross fertilization, W. SAUNDERS (*Trans. Roy. Soc. Canada 1894, pp. 139–142*).—The author reports upon the progress of experiments conducted at the experimental farms on the crossing of varieties of wheat, barley, peas, oats, and small fruits. Experiments with wheat were begun in 1888, and the chief purpose of continuing

their cross breeding has been to produce a combination of the good qualities of the parents; that is, to obtain early ripening varieties of highest quality, vigorous in growth and productiveness. To attain these ends red Fife has been crossed with Ladoga and Indian varieties. The experience with these cross-bred varieties is not yet sufficient to admit of positive statements, but it would appear that the average gain in point of earliness is about 5 or 6 days; and it is shown that the cross of the red Fife with Indian wheats is more vigorous and productive. A very promising cross has been secured between Ladoga and the white Fife. This variety, to which the name Stanley has been given, was secured in 1888. It is a beardless sport from a strongly bearded form. By selection of only the beardless heads for 6 years it is believed that the variety is now well fixed in type. "Where bearded wheat has been used as a female parent a large proportion of the crosses have been bearded. Usually with the second sowing both bearded and beardless sorts appear, the beardless varieties commonly producing bearded sports, while the bearded sorts more rarely produce beardless sports. The bearded varieties vary in length and stiffness of the beards as well as in color and character of the chaff." Some success has also been had in crossing winter and spring wheats.

In crossing varieties of barley very distinct hybrids have been produced between two-rowed and six-rowed. In the two rowed barley the additional rows found on the six-rowed form are represented by chaffy scales lying flat on the face of the head. In the hybrids produced between the two and six rowed varieties these chaffy scales are nearly all filled the first season, but the kernels are much smaller, thinner, and lighter than those which occupy the normal position on either side of the head. They have also a peculiar twist in them at each end. From the large number of new varieties of barley produced the less promising ones have been discarded, but there are still 79 under investigation.

Numerous attempts had been made to cross wheat and rye without success until in 1892, when a single cross was effected. The resulting kernel was sown in September, 1892, and produced 19 heads, but no grains were matured in any of them. The plant when young had the purplish appearance of rye, with stripes of purple on the spikelets as in rye, while the grain itself had the general appearance of a wheat grain.

About 175 crosses have been made with various varieties of peas, 83 of which are still undergoing comparative tests.

Some experiments have been made with oats to increase the earliness, productiveness, stiffness of straw, etc., and 15 promising varieties are still undergoing trial.

The author reports, under experiments with small fruits, a new raspberry which is a cross between the Cuthbert and Gregg. The progeny are all purple caps of large size, some of them prolific. Crosses are

reported between the black and white currant, and of the black currant with the gooseberry. The influence of the gooseberry and white currant characters are specially marked in the hybrids. The gooseberry sawfly, which avoids the black currant, feeds freely on the hybrids, and the mildew, which attacks the foliage of the gooseberry but not of the black currant, has been conspicuous on the foliage of the hybrids. The flower clusters are intermediate in characters between the parents, but usually resemble the black currant. No thorns have in any instance been found on the wood. The hybrids have produced flowers in abundance, but the past season no fruit was set.

Several hybrids have been obtained between the cultivated red raspberry, known as the Marlboro, and an improved form of a blackberry, known as the Agawam. One of these plants is expected to fruit the present year.

On starch and chlorophyll formation, E. Belzung (*Jour. Bot. France, 9 (1895), Nos. 2, pp. 33–40; 3, pp. 41–49; 4, pp. 61–72; 6, pp. 101–108; 7, pp. 131–136; 8, pp. 137–153; 10, pp. 181–189, pls. 2, figs. 2*).—The author has considered the phenomena of the formation of starch and chlorophyll grains (1) in the embryo in the process of formation, (2) in the embryo during germination, (3) in the adult green leaves, and (4) in the fruit. The first phases are concerned with the construction of chlorophyll grains, while phases of degeneration are shown in the fruits.

According to the author the first process taking place in the embryo is the formation of starch, a result of the activity of the protoplasm. The elaboration of the chlorophyll bodies is subsequent to starch formation, the starch grain intervening in the formation of the chlorophyll body. The chlorophyll pigment is usually diffused in the protoplasm of the young embryo, and it is rare that true chlorophyll grains are formed thus early. The substratum of the future chlorophyll body (the leucite or plastid) is always formed before the full maturity of the seed. The chromatophores are represented by small colorless or yellowish granular masses, which become green in the course of germination. The protoplasm always presents a reticulated appearance and deposits here and there along its strands minute starch grains. By a sort of intravacuolar growth the protoplasm within the amyliferous vacuoles, nourished by the starch and the principles held in its solution, becomes at last a kind of chromatophore or leucite, the starch being gradually resorbed. An exception to this rule is made in the case of starch grains destined to constitute the reserve material of the ripe seed. These continue to increase in size in the meshes where they were originally deposited.

In the case of the embryo of the white lupine, the author states that as a consequence of one part not forming reserve starch and the other using all it can lay hold of to form chromatophores, the mature seed is wanting in starch, but abundantly supplied with chromatophores. In

other cases, as in the kidney bean, the resorption of starch is only partially completed at the time of maturity, and numerous chromatophores may be found still containing starch granules. Consequently the mature embryo will present either simple grains of reserve starch and chromatophores in a transitory stage, or chromatophores arranged in the meshes of the cellular protoplasm.

The phenomena observed during the processes of germination are essentially the same as those already noted in the embryo development. In proportion as the embryo becomes green and the mass of green corpuscles more abundant, the reserve starch grains are resorbed, showing that they are used as the material for the building up of the chlorophyll grains. In those parts of the hypocotyl and cotyledons which are well illuminated the resorption of the starch grains is complete, while in the central parenchyma of the axis the starch may remain in part or wholly unchanged.

In the adult green organs, notably the leaves, the starch grains which are formed in the light within the mass of chlorophyll bodies are a product of the assimilating power of the chlorophyll, a kind of secretion of the green substance.

In the study of the fruit the interest is in the fact that toward maturity the chlorophyll bodies are gradually filled by starch grains, until finally all that remains of the original body is an almost invisible thin pellicle. The author considers the resorption of the chlorophyll which takes place at the time of the autumnal fall of the leaves as almost wholly completed within the fruit before it ripens.

The author states that the two essential phases in the life history of a plant are: "The embryonic, during which the green cell is built up and maintained by material which it has not elaborated, and the adult phase, during which the creative activity is concerned in the renewal of the embryonic conditions; the two constituting a remarkable example of the reversibility of organic activity."

Synopsis of North American Amarantaceæ, E. B. ULINE and W. L. BRAY (*Bot. Gaz., 20 (1895), No. 8, pp. 337-344*).—A synopsis is given of the following genera: Frœlichia, Gossypianthus, Guilleminia, and Cladothrix.

Some recent investigations and a critical review of the Exoascaceæ, R. SADEBECK (*Ber. deut. bot. Ges., 13 (1895), No. 6, pp. 265-280, table 1*).

The genus Sanicula in the eastern United States, E. P. BICKNELL (*Torrey Bul., 22 (1895), No. 8, pp. 351-361, pls. 5*).—Critical notes on this genus are given and 2 new species, *S. gregaria* and *S. trifoliata*, are described.

Vanillas of commerce (*Kew Misc. Bul. 104, pp. 169-178*).—Technical descriptions and critical notes are given on the various species of vanilla employed in commerce.

On three new genera of Uredineæ, P. DIETEL (*Ber. deut. bot. Ges., 13 (1895), No. 7, pp. 332-335, figs. 2*).—Masseeella, Phakospora, and Schizospora are described as new genera.

Concerning the genus Uredinopsis, P. DIETEL (*Ber. deut. bot. Ges., 13 (1895), No. 7, pp. 326-332, pl. 1*).—The position of the genus is critically discussed and 3 species described, *U. filicina*, *U. struthiopteridis*, and *U. pteridis*, the last being new.

Observations on Puccinia mirabilissima, W. C. BLASDALE (*Erythea, 3 (1895), No. 9, pp. 131–135, pl. 1*).—The author calls attention to the possibility of this being a connecting form between the genera Puccinia and Phragmidium.

Notes on Ustilago esculenta, K. MIYABE (*Bot. Mag. Tokyo, 9 (1895), pp. 194–197*).

Development of vegetable physiology, J C. ARTHUR (*Bot. Gaz., 20 (1895), No. 9, pp. 381–402; and Science, n. ser., 2 (1895), No. 38, pp. 360–373*).—Address of the vice-president, Section G, at the convention of the American Association for the Advancement of Science, Springfield, Massachusetts, August 29, 1895.

On the origin of cultivated plants, G. BATTANCHON (*Prog. Agr. et Vit., 12 (1895), No. 30, pp. 93–96*).

How far are the plant and animal bodies conformable in their chemical composition and in their metabolic transformations? E. SCHULZE (*Natur. Ges. Zurich, 39 (1894), No. 3; abs. in Bot. Centbl., 63 (1895), No. 6–7, pp. 180–184*).

Current problems in plant morphology, I, C. MACMILLAN (*Science, n. ser., 2 (1895), No. 33, pp. 183, 184*).

A study of some anatomical characters of North American Gramineæ, T. HOLM (*Bot. Gaz., 20 (1895), No. 8, pp. 362–365, pl. 1*).—The anatomical structure of the leaves of *Leersia lenticularis, L. virginica, L. monandra*, and *L. hexandra* is figured and described.

Concerning the Brownian movement, C. MALTEZOS (*Compt. Rend., 121 (1895), No. 6, pp. 303–305*).

Contribution to the study of germination, T. SCHLÖSSING, jr. (*Compt. Rend., 120 (1895), No. 23, pp. 1278–1280*).

On the circulation of phosphate of lime in plants, L. VAUDIN (*Compt. Rend., 121 (1895), No. 8, pp. 362–364*).

On the presence and rôle of starch in the embryo sac of cactus and Mesembrianthemum, E. DE HUBERT (*Compt. Rend., 121 (1895), No. 2, pp. 135–137*).

On the mucilage canals of Marattiaceæ, G. BREBNER (*Jour. Linn. Soc. Bot., 30 (1895), No. 211, pp. 444–451, pl. 1*).

On the nuclei of the Uredineæ, POIRAULT and RACIBORSKI (*Compt. Rend., 121 (1895), No. 6, pp. 308–310*).

Origin and rôle of nuclei in the formation of spores and in the act of fecundation of the Uredineæ, SAPPIN-TROUFFY (*Compt. Rend., 121 (1895), No. 8, pp. 364–366*).

The nucleolus, R. BEER (*Nat. Sci., 7 (1895), No. 43, pp. 185–192*).—The author reviews the literature of the subject, and calls attention to our imperfect knowledge of the chemical, structural, and physiological relations of the nucleolus.

The teleutospores of Uredo aspidiotus, P. MAGNUS (*Ber. deut. bot. Ges., 13 (1895), No. 6, pp. 285–288, pl. 1*).

Concerning the mineral requirements of the plant cell, O. LOEW (*Bot. Centbl, 63 (1895), No. 6–7, pp. 161–170*).

On stipules, their form and functions, II, J. LUBBOCK (*Jour. Linn. Soc. Bot., 30 (1895), No. 211, pp. 463–532, figs. 7*).

On year ring formation, G. HABERLANDT (*Ber. deut. bot. Ges., 13 (1895), No. 7, pp. 337, 338*).

Albuminoids and carbohydrates as assimilation products of green leaves, W. SAPOZNIKOW (*Inaug. Diss. Tomsk, 1894, pp. 61, pl. 1; abs. in Bot. Centbl., 63 (1895), No. 8, pp. 246–251*).

Root tubercles of Leguminosæ, E. F. SMITH (*Amer. Nat., 29 (1895), No. 346, pp. 898–903*).—An abstract of Gonnermann's article in *Landw. Jahrb., 23 (1894), No. 405, p. 649* (E. S. R., 6, p. 784).

Concerning the nitrogen assimilation of certain legumes, their relation to agriculture, with special reference to Swiss conditions, J. BILLWILLER (*Inaug. Diss. Bern, 1895, pp. 50; abs. in Bot. Centbl., 63 (1895), No. 4–5, pp. 152, 153*).

Organisms in soil assimilating nitrogen from the atmosphere, R. WARINGTON (*Agl. Students' Gaz., 1895, July, pp. 105–108*).

Teratological notes, F. E. LLOYD (*Torrey Bul., 22 (1895), No. 9, pp. 396, 397, pl. 1*).—Notes are given on *Quercus garryana.*

Concerning seasonal dimorphism as the starting point for the formation of new species in the plant world, R. VON WETTSTEIN (*Ber. deut. bot. Ges., 13 (1895), No. 7, pp. 303–313, pl. 1, fig. 1*).

Supplement to the Portland Catalogue of Maine Plants, M. L. FERNALD (*Proc. Portland Soc. Nat. Hist., 2 (1895), No. 3, pp. 73–96*).—The author has given a critical list of 155 species of phanerogams and vascular cryptogams as an addition to the previously published Portland Catalogue. In a general summary it is shown that of flowering plants and higher cryptogams there are known to be 1,656 species and varieties growing within the State.

Contributions to the arboreal flora of Java, S. H. KOORDERS and T. VALETON (*Mededeel's Lands Plantentuin, No. 14, pp. 228*).—This is Part II of the author's Arboreal Flora of Java.

Contributions to the Queensland flora, F. M. BAILEY (*Dept. Agr. Brisbane, Bul. 10, pp. 48, figs. 2*).—Critical notes and descriptions are given of Queensland plants. The popular names with their botanical equivalents are given for an extensive list of plants.

New fungi from various localities, J. B. ELLIS and B. M. EVERHART (*Torrey Bul., 22 (1895), No. 8, pp. 362–364*).—*Fomes tinctoria, Ustilago arenariæ, U. mulfordiana, U. monilifera, Puccinia ligustici, P. nesaa, Ravenelia arizonica, Doassansia affinis, Æcidium sphæralceæ*, and *Peronospora whippleæ* are described.

The popular use of wild plants, A. CHABERT (*Bul. Herb. Boissier, 3 (1895), Nos. 6, pp. 291–301; 7, pp. 331–341*).—Descriptions are given of those plants which are commonly used in popular medicine, as dyes, oils, wood, liquors, and those reputed as being poisonous.

BACTERIOLOGY—FERMENTATION.

Concerning the axes and planes of bacilli, O. MÜLLER (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 221–224, pl. 1*).

Bacteria of sputa and the cryptogamic flora of the mouth, II, F. VICENTINI (*Internat. Jour. Micr. and Nat. Sci., 5 (1895), No. 27, pp. 300–323*).

The physical and chemical explanation of fermentation phenomena, E. PRIOR (*Wochenschr. Bierbrauerei, 1895, p. 111; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 12, pp. 442–446*).

Studies on immunity, E. METCHNIKOFF (*Ann. Inst. Pasteur, 9 (1895), No. 6, pp. 462–506, pl. 1*).—On the extra-cellular destruction of bacteria in the organism.

On natural pure cultures of yeasts, M. DELBRÜCK (*Wochenschr. Brauerei, 1895, Nos. 3, 4, and 5; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 3, pp. 221–227*).

Laboratory guide for the bacteriologist, L. FROTHINGHAM (*London: Henry Kempton, 1895*).—Gives instructions for the preparation of specimens, staining methods, culture media, etc.

The peptonizing bacteria of cows' milk, S. STERLING (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 13–14, pp. 473–482; abs. in Chem. Ztg., 19 (1895), No. 64, Repert., p. 221*).

Concerning Link's lactic acid-forming Vibrios, GOSIO (*Arch. Hyg., 21 (1894), p. 114; abs. Centbl. Bakt. und Par. Allg., 1 (1895), No. 2, p. 89*).

Determination of the heat disengaged in alcoholic fermentation, A. BOUFFARD (*Compt., Rend., 121 (1895), No. 8, pp. 357–360; Prog. Agr. et Vit., 12 (1895), No. 39, pp. 345–347*).

Investigations concerning the yeast species and sugar-forming fungi of arrack production, F. A. F. C. WENT and H. C. P. GEERLIGS (*Verhandl. Kgl. Acad. Wissensch. Amsterdam, ser. 2, 1895, IV, No. 2; abs. in Bot. Centbl., 63 (1895), No. 4-5, pp. 148-150*).

On the detection of laccase in plants, G. BERTRAND (*Compt Rend., 121 (1895), No. 3, pp 166-168*).

Action of diastase on starch, A. R. LANE and J. L. BAKER (*Jour. Chem. Soc London, 1895, Aug, pp. 702-708, 739-746*).

On the partial reversion of cane sugar through microörganisms, C FERMI and G. MONTESANO (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 13-14, pp. 482-487; 15-16, pp. 542-556*).

Microbes in health and disease, E. M. CROOKSHANK (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp 343-351*) —A popular article dealing in a general way with the classification of bacteria and with pathogenic organisms.

Investigations on bacteria, H. L RUSSELL (*Bot. Gaz., 20 (1895), No. 9, pp. 419-422*).—A review of a paper by A. Fischer in *Jahrb. Wiss. Bot., 27 (1895), pp. 1-163.*

Recent advances in bacteriology with special reference to food, M. V. BALL (*Jour. Franklin Inst., 1895, Nov, pp. 340-351*).

A contribution to the biology of the florescent bacteria, K. THUMM (*Arb. Bakt. Inst. Hochschule, Karlsruhe, 1 (1895), No. 2, p. 291; abs. in Bot. Centbl., 63 (1895), No. 4-5, pp. 114, 115*).

A contribution to the knowledge of obligate anaërobic bacteria, R. GERSTNER (*Arb. Bakt. Inst. Hochschule, Karlsruhe, 1 (1895), No. 2, p. 148, pls. 2; abs. in Bot. Centbl., 63 (1895), No. 4-5, pp. 115-117*).

The significance of bacterial products in the separation of species, P. SCHNEIDER (*Arb. Bakt. Inst. Hochschule, Karlsruhe, 1 (1895), No. 2, p. 201; abs. in Bot. Centbl., 63 (1895), No. 8, p. 245*).

The use of air tight and bacteria proof vessels in bacterial work, R. BURRI (*Centbl. Bakt und Par. Allg., 1 (1895), No. 17, pp. 627-629, figs. 2*).

Concerning pure cultures in tubes with agar and blood serum, G BANTI (*Centbl Bakt. und Par. Med., 18 (1895), No. 7, pp. 203, 204*).

Concerning agar preparation, L. ZUPNIK (*Centbl. Bakt. und Par. Med., 18 (1895), No. 7, p. 202*).

On the value of certain mineral salts for fungi, C. WEHMER (*Ber. deut. bot. Ges., 13 (1895), No. 5, pp. 257-265*).—The author gives the effect of a number of salts when used in nutrient solutions for fungi.

Methods of coloration employed in bacteriology, NICOLLE (*Ann. Inst. Pasteur, 9 (1895), No. 8, pp. 664-670*).

On the bacteria which reduce nitrates and the loss of nitrogen which they cause, R. BURRI and A. STUTZER (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 7-8, pp. 257-265; 9-10, pp. 350-364; 11, pp. 392-398; 12, pp. 422-432*).

Concerning the bacteria in manure and their physiological rôle in its decomposition, S. A. SEVERIN (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 3, pp. 97-104; 4-5, pp. 160-168*).

Concerning nitrification, R. BURRI (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 1, pp. 22-26; 2, pp. 80-81*).—A resumé and bibliography.

Contributions on the morphology of the organisms of nitrification (*Arch. Sci. biol. Imp. Inst. Med. St. Petersburg, 1, No. 1-2, p. 87; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 6, pp. 243-245*).

Nitrate-reducing bacteria and their effect on the nitrogen of barnyard manure, S. KOENEN (*Organ Ver. Oudleer. Rijks. Landbouwschool, 7 (1895), No. 85, pp. 221, 222*).

The resistance of spores of Aspergillus fumigatus, RENOU (*La semaine medicale, 1895, No. 8: abs. in Centbl. Bakt. und Par. Med., 18 (1895), No. 2-3, p. 79*).—The

spores resisted rather strong solutions of silver nitrate, iodin, potassium iodid, and soda.

The suppression of bacteria by means of lysol, J. WEIFS (*Pharm. Ztg., 40 (1895), p. 406*).

Bactericidal action of metals, E. F. SMITH (*Amer. Nat., 29 (1895), No. 346, pp. 933-936*).—A review is given of a paper by M. Bolton on "The effects of various metals on the growth of certain bacteria."

The streptococcus and antistreptococcic serum, A. MARMOREK (*Ann. Inst. Pasteur, 9 (1895), No. 7, pp. 593-620, figs. 5*).

METEOROLOGY.

Papers in terrestrial magnetism and atmospheric electricity (*U. S. Dept. Agr., Weather Bureau Bul. 11, pt. 2, Rpt. Internat. Meteorolog. Congress 1893, pt. 2, pp. 460-583, Pls. XIV-XXV*).

(1) *Magnetic survey of North America, C. A. Schott* (pp. 460-464).—An account of the discovery of points in the Atlantic agonic line by Columbus, 1492, and Cabot, 1497; of the contributions to magnetic data by Drake, Hudson, Champlain, Baffin; of the *Del Arcano del Mare* and Gilbert's *De Magnete.* Also an account of the advances in the present century as contributed by Humboldt 1798–1803, Lefroy 1842–'44, Sabine 1840–'45, Kane 1853–'55, Hayes 1860–'61, Hall 1871, Nares and Markham 1875–'76, Greely 1881–'84; and especially by the operations of the observers of the United States Coast and Geodetic Survey at Philadelphia 1840–'45, Key West 1860–'66, Madison 1878–'81, Los Angeles 1882–'89, and San Antonio 1890–'93. The work at Toronto and Washington (United States Naval Observatory) and the Stations of the International Polar Research Expeditions at Uglaamie, Alaska, and Fort Conger, Grinnell Land, 1882–'83, is recounted, together with that of several other exploring expeditions.

(2) *Magnetic survey of Europe and Asia, A. de Tillo* (pp. 465-469, Pl. XIV).—A sketch is given of the surveys of the several countries, with an attempt to estimate the completeness of the same at the present time. Sabine's charts 1872–'76 give the summary of our knowledge up to the year 1850. For the British Islands the latest authority is Rücker and Thorpe, 1890, and is regarded of great value. For France the earlier work of Lamont 1856–'57 is supplemented by that of Mascart and Moreaux 1866, and is rated first class. For Germany the survey of Lamont 1844–'59 and the partially completed work of Neumayer is also in the first class. For Austria-Hungary the investigations of Kreil 1843–'54 and Schenzl 1864–'81 are the most prominent. For Russia the work of Hansteen, Smirnow, Wild, Tillo, and others have covered a large region, but with sufficient completeness to be rated only second class. For India the surveys of the brothers Schlagintweit 1854–'58, and for Indo-Malaia those of Elliot and Van Rijckevorsel are the chief authorities, the completeness being second class. For

Siberia, China, and Arabia third rate surveys have been taken. A map shows the areas of these surveys and the regions of no observations.

(3) *The international polar expeditions, 1882–'83, C. Börgen* (pp. 469–485).—The survey of the polar regions had been confined to a few observations by exploring expeditions till the year 1882, when the plan of Weyprecht was put in operation for a series of simultaneous observations surrounding the poles. An account is given of the several preliminary congresses, and the plan of operations finally formulated, the occupation of 12 stations in the Northern Hemisphere and 2 stations in the Southern, with many coöperating stations in lower latitudes. An interesting report of the success of most of the expeditions follows, and a graphic picture of the hardships of Greely's retreat from Fort Conger. A very intelligent summary of the scientific results is given, the value of the material secured, and the chief lesson of failure in the attempt to draw accurate observations from instruments whose operation depends upon the induction of soft iron.

(4) *The discovery of magnetic declination made by Christopher Columbus, Fr. T. Bertelli, B*[a] (pp. 486–492).—The author advances a series of arguments to show that the declination of the magnetic needle was not known before the time of Christopher Columbus, and that he discovered the same on his first voyage to America. The Chinese knew only the rough directive use of the needle; the Mediterranean navigators were also without knowledge of the declination, as proven by examination of their charts, by their instructions for navigation, by the roses or rhombi on the charts, by the coast lines of the earlier geographical maps as compared with the latter. The arguments in favor of the discovery by Columbus are the facts that he adjusted his compasses to satisfy the fears of his pilots; that his son Fernando distinctly attributed the discovery to him ("no one had known of such a variation till then"); that the agonic line gave rise to the boundary between the Spanish and Portuguese possessions, and that this discussion began after the first voyage of Columbus.

(5) *The cosmical relations manifested in the simultaneous disturbances of the sun, the aurora, and the terrestrial magnetic field, S. Lemström* (pp. 492–500, Pl. XV).—An account is given of the discovery and illustration of the connection between sun spots, auroras, and magnetic variations, by Baué Wolfe, Fritz, and Loomis. The extension of their relation to meteorological variations by Bigelow is also described. The author mentions the several theories advanced to account for these interrelated phenomena. He inclines to the view that the sun emits at different times different wave lengths which are therefore more or less absorbed by the earth's atmosphere and cause the observed effects. Especially this modifies the action of the unipolar induction of electricity, and so causes disturbances of the state of equilibrium. An application of this process is made by comparing the harvests of Wasa

and Kuopie, 1810–'77, with the variations of the solar output, and the result shows that the former depends very closely upon the latter.

(6) *The periodic terms in meteorology due to the rotation of the sun on its axis, F. H. Bigelow* (pp. 500–510, Pls. XVI–XVIII).—This paper contains a brief summary of the variations in the several meteorological elements in the period of the sun's equatorial rotation. The action is ascribed to the polar magnetic field emitted by the sun falling upon the polar regions of the earth and along the magnetic meridians. A set of fifteen curves is appended which show, as is to be expected from this preliminary compilation of the material, a rough and yet unmistakable tendency to vary like the curve derived from the European magnetic field and like that of the sun spots along the solar meridians. These curves embrace the lows of the United States, the lows and highs of the North Atlantic, the weather at Bismarck, Chicago, Washington, and in Europe, European temperatures and relative humidity, atmospheric electricity, thunderstorms of the United States, and the number of high and low centers in the Northern Hemisphere.

(7) *Review of recent investigations into the subject of atmospheric electricity, J. Elster and H. Geitel* (pp. 510–522).—A general review of the results of various investigators into the subject of atmospheric electricity is given. Particular attention is called to the important advances due to the invention of the electrometer by Sir W. Thomson and the reduction of the measures to absolute units; to the division of the observations by Exner into clear and cloudy weather phenomena; the gradual deduction of the laws of diurnal and annual variations by several investigators; the several theories to account for the existence of the electric potential fall in the atmosphere. Finally, the work of the authors in discussing the action of the ultraviolet light falling upon zinc surfaces and the consequent extension of the principles to the atmosphere is detailed. This is a very interesting and valuable summary of the knowledge of this science.

(8) *On the construction of earth magnetic instruments, M. T. Edelmann* (pp. 522–539).—Under the general heading of station apparatus is given a description of the various forms of instruments that have been constructed for the measurement of the declination, horizontal force, and vertical force; that is, the declinometer, the inclinometer, the magnetometer, the magnetic variation apparatus, the magnetic intensimeter, the Lloyd balance, and the Lamont induction apparatus. Under the heading "Portable apparatus" is described the Wild portable theodolite, the combination for determination of declination, the combination for oscillation observations, the adaptation for deflection, and the arrangement for the determination of the inclination. A full series of diagrams accompanies the paper, which forms the most complete brief account of magnetic instruments accessible to the public.

(9) *On some improvements in magnetic instruments, M. Eschenhagen* (pp. 539–550).—The installation of the Magnetic Observatory at Potsdam has given the author the opportunity to put in practice several very important devices for increasing the sensitiveness and efficiency of the apparatus of a primary station. The details are minute and specific so as to be useful to other magneticians. The mode of setting the threads, the marks, the movements of the telescopes, the form of the magnet bars and mirrors, the collimation, the method of signals to comparison observations, the systematic scheme or order of observation, the best methods for suspension and the threads to be used, the length of the time scale, the mode proposed for exchanging traces of different observatories, the recording apparatus, and other interesting topics are included in this essay. The author's well-known success in this line of work and the excellent results obtained by him make the experiences here noted of great importance to the practical observer.

(10) *The present condition of mathematical analysis as applied to terrestrial magnetism, A. Schuster* (pp. 550–569, Pl. XIX).—This paper gives an account of the harmonic analysis, as applicable to terrestrial magnetism, in a brief summary. Gauss's method of obtaining the coëfficients in the harmonic analysis of the magnetic potential is described and the constants as derived by Gauss, together with Petersen's revision of the same, are recounted. Neumann's abbreviated method for obtaining the coëfficients is described, with a short criticism of the same. After this follows a discussion of the most suitable method to be adopted in future reductions, with the purpose of arriving at the solution of the problem of the secular variation of the terrestrial field. The paper concludes with a treatment of the diurnal variation, the data depending upon four stations. The relation of this problem to the solar and cosmical phenomena is indicated, and the essay, though condensed, is a very significant contribution to this fascinating subject.

(11) *Methods and instruments of precision for the study of atmospheric electricity, A. B. Chauveau* (pp. 569–583, Pls. XX–XXV).—An historical review of the different observations of atmospheric electricity, and the instruments used, is given, including the methods of observation, by the insulated conductor, by the method of Pelteer, the method of Volta, and the process of Sir W. Thomson. A detailed description of Mascart's register, collector, and electrometer is added, the abstract of the observations, and the details of a portable apparatus. The most important section of the paper gives an account of the method of measuring high potentials, as employed at the Central Meteorological Bureau, and the Eiffel Tower, Paris, and a set of curves is appended showing the variations of the field on the ground and on the tower. The accompanying weather notes enable the reader to judge of the prevailing atmospheric conditions. By this process observations at very different potentials can be recorded by the same self-registering apparatus.—F. H. BIGELOW.

Thunderstorm studies based on balloon voyages, L. SONNCKE (*Abhandl. Bayer. Akad Wiss., München, 1894, vol. 18, pp. 60*).—This is an exhaustive study of 60 quarto pages upon the conditions in the free atmosphere favorable to the formation of thunderstorms, dwelling especially upon the conditions on June 19, 1889. The author indicates that for a stable equilibrium the temperature diminution with height must be less than 5.4° per 1,000 ft. This may be expected as long as there is no condensation of the vapor in the free air. If there is a greater temperature decrease the condition becomes unstable and there is occasion for rising air currents. Observations on the Sonnblick, 10,000 ft. high, are reported to confirm this statement. On this mountain, June 19 at 6 a.m., there were stratus clouds in the south, at 7 the sky was half covered, at 9 thunder heads, at 1 p.m. summit covered with clouds, at 4 rain began, and at 7 thunderstorm with snow. The observations showed that in the forenoon with a clouded sky there was a diminution of 5.4° per 1,000 ft. instead of the normal 3.9°.

Very full observations taken in the balloon "Herder" at Munich are given; also those taken in the "Nautilus" at Berlin. The "Herder" left the earth at 7.55 a.m., and rose in 4 hours to a height of 65,000 ft. The relative humidity ranged from 56 per cent at 2,280 ft. to 93 per cent at 3,540 ft. and dropped again to 63 per cent at 6,500 ft. The diminution of temperature with height was 1.6° per 1,000 ft. at 2,280 ft. at 8.20 o'clock, and at 11 o'clock at 3,600 ft. it was 5.8°.

At Berlin the balloon rose at 7.6 a.m. The diminution in temperature at 1,070 ft. was 1.8° per 1,000 ft.; at the highest point, 11,960 ft., it was 3.7° at 11 o'clock. At 1.35 the diminution was 6.8° at 3,790 ft., but this last value was due in part to the rapid descent of the balloon, which carried with it the lower temperature of the higher atmosphere, there having been a drop of 3,940 ft. in 5 minutes. The lower limit of the cloud formation as shown at some of the mountain stations was 4,920 to 5,250 ft. The "Herder" balloon passed into cumulus cloud at 5,460 ft. The "Nautilus" found dark clouds at 9.5 o'clock at 5,760 ft., and at 9.51 the clouds were at 6,350 ft.

At most of the stations the wind was light at 10 to 11 with a sudden change in direction about that time. In many cases there was a stoppage in the regular diurnal rise in temperature at about 10.30, due to cloudiness, probably. Freezing temperature was reached at 10,890 ft. and at 8,000 ft. in the "Nautilus" and "Herder," respectively. It was found that the stratum of 32° temperature was higher in the cloud than outside of it. A sinking of cirrus cloud to a lower level was noticed, and the evaporation of the ice crystals would tend to cool the air.

The thunderstorms occurred in the Alps at noon, but at the lower stations from 4 o'clock to 6. In the Alps the lowest pressure, highest relative humidity and temperature, and the highest clouds were at noon.

According to the author's view, the abundance of high potential electricity is due to friction between water and ice particles at great

heights. The thunderstorm is maintained so long as this friction process continues. That there is abundant relative motion between air layers is shown in balloon experiences. Also great differences in direction and velocity of cloud layers above is noticed at the earth. A balloon car is often thrown violently about by air currents. He also cites the general presence of hail in thunderstorms, as a proof of violent commotion, since the various layers are deposited by rapid motion from a warm and cold region and *vice versa*.—H. A. HAZEN.

Report of the International Meteorological Congress, held at Chicago, Illinois, August 21–24, 1893 (*U. S. Weather Bureau Bul. 11, pt. 2, Washington, 1894–'95, pp. XV–XVI, 207–583, pls. 16*).—This report is edited by O. L. Fassig, secretary. Most of the individual papers comprising this report have already been noticed in the Record. The portion of the report mentioned above contains: Section IV, history and bibliography (14 papers); Section V, agricultural meteorology (6 papers), and Section VI, atmospheric electricity and terrestrial magnetism (11 papers). Part III of the report, which is in press, will contain Sections VII–IX, relating respectively to climatology, instruments, and methods of observation, and to theoretical meteorology.—O. L. FASSIG.

Meteorology, 1894, C. H. JOHNSON (*Massachusetts State Sta. Rpt. 1894, pp. 470–475*).—This includes notes on the character of the season and monthly summaries of observations on temperature, precipitation, direction of wind, and casual phenomena. The summary for the year is as follows: *Temperature* (degrees F.), maximum 98 (July 10, 11, and 12), minimum −18 (February 25), mean 47.39, mean daily range 22.10; *precipitation*, total (inches) 32.08; *snowfall* (inches) 71.45.

North Carolina weather during the year 1894 (*North Carolina State Weather Service Rpt., 1894, pp. I–XLXI, 1–256, maps 26*).—This report includes a list of publications of the State Weather Service during 1894; lists of meteorological stations and observers and crop correspondents; notes on the distribution of forecasts; an account of the river and flood service in North Carolina; a meteorological summary for the year as compared with previous years (1888–'93); comparisons of temperature in North Carolina, the United States, and in foreign countries, and charts of normal annual temperature and precipitation for North Carolina.

The annual summary is as follows: *Temperature* (degrees F.).—Mean, 59.6; normal, 59.0; departure, +0.6; maximum, 104, June 28; mean maximum, 69.7; minimum, −10, December 29; mean minimum, 49.9; mean monthly range, 48.2; mean daily range, 19.9; absolute range, 114. *Pressure* (inches).—Mean, 30.11; normal, 30.08; departure, −0.03; maximum, 30.78, February 24; minimum, 29.26, October 9; absolute range, 1.52. *Relative humidity*, normal (per cent), 74.6. *Precipitation* (inches)—Average, 46.57; normal, 53.29; departure, −6.72; greatest monthly, 14.99; least monthly, 0.29. *Wind*.—Prevailing direction, SW.; aver-

age direction for many years, SW.; maximum velocity (miles per hour), 60, September 27 and October 10. *Weather.*—Number of clear days, 152; number of cloudy days, 101; number of rainy days, 108; number of partly cloudy days, 112.

"The features of interest during the year 1894 were the annual deficiency in precipitation, amounting to over 6 in., and the extraordinary warm period during March, from the 1st to the 25th, during which the temperature averaged 12° per day above the normal, which was followed by a severe freeze, killing the fruit crop almost completely. Six months of the year were above the normal in temperature, March leading, with an excess of over 6°. In October and September subtropical cyclones occurred, which were, however, of less violence than those which crossed the State in 1893.

"The annual mean pressure varies from 30.11 to 30.02; this year it was relatively high. The annual mean temperature was correspondingly high. . . .

"Recapitulating briefly the final results of the season, it may be said that the crop of rice was excellent. The yield of corn was greater than usual, as the acreage was increased, and its condition continued superior to previous years. Though the final probabilities for cotton indicated a less crop than anticipated, taking everything into consideration but little, if any, less than an average crop was gathered. Tobacco was not quite as good as other crops, though cures were generally bright. The minor crops, as peanuts, field pease, sweet potatoes, sorghum, turnips, and cabbage, were all excellent. On the whole the season of 1894 in North Carolina was a good one.

Notes on climate, J. D. CONLEY (*Wyoming Sta. Bul. 23, pp. 85-96*).—This includes notes on the character of the season at the station and at the different substations, and tabulated summaries of observations on temperature, pressure, precipitation, humidity, dew-point, wind movement, and terrestrial radiation at Laramie and on temperature and precipitation at a number of other points in the State. The following is a general summary for the year:

Meteorological summary for Wyoming, 1894.

	Laramie.	Lander.	Saratoga.
Temperature (degrees F.):			
Highest	87.6 (July 11)	94.0 (July 10)	88.0 (July 10).
Lowest	−27.0 (Dec. 28)	−24.0 (Feb. 20)	−29.0 (Dec. 27).
Highest monthly range	30.0 (August)	35.9 (August)	42.8 (October).
Lowest monthly range	19.9 (January)	21.8 (March)	20.1 (March).
Highest annual mean		43.4	
Lowest annual mean	39.9		
Precipitation, lowest (inches)	7.63		

	Sheridan.	Sundance.	Wheatland.
Temperature (degrees F.):			
Highest	96.0 (Aug. 27)	94.0 (July 30)	99.0 (July 11).
Lowest	−36.0 (Jan. 24)	−28.0 (Jan. 23)	−22.0 (Jan. 26).
Highest monthly range	38.9 (August)	30.5 (August)	37.8 (September).
Lowest monthly range	24.5 (March)	18.9 (January)	22.8 (March).
Highest annual mean			
Lowest annual mean			
Precipitation, highest (inches)		19.99	

The average temperature for all stations except Wheatland was 41.7; the average precipitation for all places furnishing complete records was 12.42 in.

Additional observations at Laramie were as follows: Highest terrestrial radiation, 11, September 27; lowest terrestrial radiation, 0, April 12 and April 30; lowest relative humidity, 10.6, June 26; mean relative humidity for the year, 56.4; highest dew point, 56.2, July 3; lowest dew-point, 23, December 28; mean dew-point for the year, 22.5; greatest monthly evaporation, 7.492 in.; total evaporation for 6 months from April 26 to October 27, 37.166 in.

Agricultural meteorology, F. HOUDAILLE (*Météorologie agricole. Paris: Gauthier-Villars et fils, pp. 214, figs. 17*).—The objects attempted in this work are to give to the practical agriculturist a concise and clear explanation of the elementary principles of meteorology and practical methods for predicting atmospheric changes and protecting against them. The book is divided into three parts. The first part is devoted to a brief statement of the general principles relating to the constitution of the atmosphere and the laws which govern its movements. In the second part the simpler and more practical methods of taking meteorological observations are described, with illustrations of instruments. The third part explains the principal applications of meteorology to agriculture, including weather forecasting, the influence of the different meteorological elements on plants and animals, and means of protection against unfavorable weather conditions.

Relations of the Weather Bureau to the science and industry of the country, W. L. MOORE (*Science, n. ser., 2 (1895), No. 41, pp. 576–582; and Amer. Met. Jour., 12 (1895), No. 7, pp. 209–218*).

Weather fallacies, R. INWARDS (*Jour. Roy. Agr. Soc. England, ser. 3, 6 (1895), No. 23, pp. 568–581*).—An address.

Relation of clouds to rainfall, H. H. CLAYTON (*Amer. Met. Jour., 12 (1895), No. 4, pp. 110–116, fig. 1*).

Semiarid Kansas, S. W. WILLISTON (*Kansas Univ. Quart., 3 (1895), No. 4, pp. 209–216, map 1*).

Report on the work of the station of agricultural climatology of Juvisy, 1894, C. FLAMMARION (*Bul. Min. Agr. France, 14 (1895), No. 3, pp. 290–316*).

Meteorological observations at Massachusetts Hatch Station (*Massachusetts Hatch Sta. Met. Buls. 78, 79, and 80, pp. 4 each*).—The usual summaries of observations at the meteorological observatory of the station during June, July, and August.

Meteorological observations, H. B. BATTLE, C. F. VON HERRMANN, and R. NUNN (*North Carolina Sta. Met. Buls. 67, pp. 55–67, maps 2; 68, pp. 71–87, maps 2; 69, pp. 89–102, maps 2; 70, pp. 105–119, maps 2; 71, pp. 123–139, maps 2*).—These bulletins contain the usual summaries of observations during the months of April, May, June, July, and August, 1895.

AIR—WATER—SOILS.

The artesian water of South Dakota, J. H. SHEPARD (*South Dakota Sta. Bul. 41, pp. 76, figs. 2*).—A systematic chemical investigation of the artesian water supply of South Dakota has been undertaken and "in order to cover the field as completely as possible wells were chosen which were geographically distributed as uniformly over the whole artesian basin as the circumstances of the case would permit." Analyses are reported of water from 20 different wells, which are described, showing the mineral constituents of the water and the soluble and insoluble salts after evaporation. A summary of the results is given in the following table:

Analyses of artesian waters.

[Principal salts (parts per 1,000).]

	Sodium chlorid ($NaCl$).	Sodium sulphate (Na_2SO_4).	Sodium carbonate (Na_2CO_3).	Magnesium sulphate ($MgSO_4$).	Magnesium Carbonate ($MgCO_3$).	Calcium sulphate ($CaSO_4$).	Calcium carbonate ($CaCO_3$).	Total salts.	Soluble after evaporation.	Insoluble after evaporation.
Yankton	0.1643	0.1172	......	0 3160	......	0.8700	0 1246	1.6023	0.5975	1.0048
Tyndall	.2438	.1002	......	4036	......	1 1199	.0905	1.9902	.7476	1.2426
Armour	.2879	.1186	......	.5011	......	1 0550	.1554	2.1392	.9076	1.2316
Chamberlain	.1800	.3618	......	4735	......	.8920	.1573	2.0850	1.0153	1.0697
Kimball	.1688	.2211	......	4834	......	1 0592	.1636	2.1123	.8733	1.2390
Woonsocket	.1128	.7941	......	3701	......	5360	.1630	2.0088	1.2770	.7318
Pierre	2.8052	......	0 5711	......	0 0050	......	0771	3.4760	3.3763	.0997
Harrold	.8029	.4550	.3817	......	.0575	......	.0286	1.7379	1.6396	.0983
Miller	.1501	1.2265	......	2657	......	.1683	.2125	2.0323	1.6423	.3900
Huron	.2046	.6083	......	.4261	......	.6020	.1554	2.0334	1.2390	.7944
Iroquois	.2598	1.6153	.2432	......	0353	......	.0195	2 1831	2.1183	.0648
Hitchcock	.1595	.6120	......	.4384	......	.6989	.1534	2 0868	1.2099	.8769
Faulkton	.6610	.7891	3814	......	.0716	......	0471	1.9796	1.8315	.1481
Redfield	.2626	1.5701	0499	......	.0664	......	.0854	2.0546	1.8826	.1720
Doland	.3473	1.5091	.2057	......	0512	......	0230	2.1537	2 0621	.0916
Northville	.6396	.1620	......	3988	......	2280	5580	2.0380	1.2004	.8376
Ipswich	.8089	.5076	.7079	......	.0557	......	.0239	2.1180	2 0244	.0936
Aberdeen	.2381	1 6538	.0108	......	0811	......	.0879	2.0909	1.9027	.1882
Andover	.3308	1.6573	2476	......	0449	......	.0248	2.3236	2.2357	.0879
Westport	1 5031	.4177	.5475	......	.0386	......	0200	2 5501	2 4083	.0818

The effects of the different salts in the human system and upon soils and plants, the source of the artesian water, and the value and use of the water for irrigation are discussed, and suggestions made regarding the construction of artesian wells.

"The preponderance of physical and geological evidence points to the outcrops of the Dakota sandstone, lying along the foothills of the Rocky Mountains to the north and west of the Dakota basin, and to outcroppings of the same sandstone around the Black Hills, as the points of entrance of the waters in question. It is believed that the waters of the melting snows and of the rainfall of large areas lying above these outcrops furnish the great artesian supply. . . .

"The conditions prevailing in South Dakota are such that all problems relating to artesian irrigation must be decided upon by taking into account factors immediately concerned and factors that are unique to this region. It is undoubtedly true that the artesian waters of the Dakota basin do cairy large quantities of soluble constituents. The residues from these waters are larger than those of most waters used for irrigation; but when the various climatic conditions of the basin are taken into consideration, and when the drainage and soil conditions of the most favorable kind are considered, it is not unwarrantable to suppose that favorable results may be obtained by an economic and judicious application of the artesian waters. Especially is this true when one remembers that during many years no irrigation is at all desirable. And then again all parts of the basin are subject to such heavy falls of rain that any accumulating salts must of necessity be washed away. Then again, even in the dryest years, the period when crops would be benefited by irrigation is short, so that only a limited application of water would be needed. All these facts would lead one to believe that such irrigation as is needed here may be accomplished by artesian waters.

"In all probability success may be confidently expected by a strict attention to the following details: Deep and thorough cultivation, a judicious use of only sufficient water to insure a crop, a careful conservation of all storm waters, the systematic planting of trees and shelter belts, and the storage of all surplus artesian waters.

Moreover, it must be remembered that the second-flow wells are safer than first-flow wells, especially on land at all inclined to be clayey. And, finally, should evil effects from the water become manifest, the remedial agencies of land plaster, lime, and underdrainage should be promptly applied. The large deposits of gypsum occurring in the Black Hills will be sufficient for all time."

Preservation of moisture in the soil by cultivation, S. A. KOODASHEFF (*Imp. Free Econ. Soc. St. Petersb., Bul. 1, 1894, pp. 1-13*).—This is an elaborate report of experiments conducted by Prince Koodascheff at an agricultural experiment station established by him in 1878 in the government of Poltova. The experiments were conducted on 5 plats, 4 of which consisted of 81 acres each, and 1 of 27 acres. The plats were treated as follows:

Plat 1.—Manured, plowed 5¼ in. deep in the early spring, and replowed at the end of June 10 to 10½ in. deep.

Plat 2.—Same treatment as plat 1 except that it was replowed 5¼ in. instead of 10½ in.

Plat 3.—Same as plat 1 except that no manure was applied during the whole experimental period (10 to 12 years).

Plat 4.—Same as plat 2 except that no manure was applied.

Plat 5.—Treated in accordance with the old-fashioned method prevailing in Little Russia among the peasants since time immemorial, *i. e.*, manuring the field by letting cattle graze to the end of June, then plowing it 7 in. deep immediately after a rain, if possible, and finally seeding at the end of August.

In order to determine the most favorable time to begin plowing for the winter crop each of the first 4 plats was subdivided into 3 subplats. The plowing of the first subdivision in each case was completed May 3, of the second June 22, and of the third July 22.

From the results of the observations and experiments the following conclusions are drawn:

(1) To secure the best harvests of winter crops in localities with climatic and soil conditions similar to those obtaining in these experiments, the preservation of moisture of the soil is the fundamental principle on which all the processes of cultivation ought to be based, because the absence of moisture, owing to specific properties of the climate, is the main and almost the exclusive cause of poor crops.

(2) For all other regions having similar climatic and soil conditions to those of Poltova the most favorable time to begin tillage and preparation of the soil for winter crop is the early spring—the earlier the better, with an absolute proviso that (3) all the successive operations in preparing the soil for winter crop up to the time of seeding must depend upon the principle of preserving the moisture provided during the winter period.

The author discusses the principles determining the movement of soil water and the influence of cultivation in controlling the loss of water from the soil. He points out (1) that manured soils do not require as

much cultivation as those not manured; (2) compactness of the soil, due to external influences, such as rain, rolling, etc., necessitates a greater amount of cultivation; and (3) the warmer the soil and the more regularly it is cultivated the sooner it is prepared for seeding.—A. K. MLODZIANSKY.

On the possibility of the occurrence of hydrogen and methane in the atmosphere, F. C. PHILLIPS (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 801–808*).

Analyses of water, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 409–416*).—Analyses of 200 samples of water with reference to sanitary condition are reported, together with Wanklyn and Chapman's rules for interpreting the results.

Analyses of water, M. B. HARDIN (*South Carolina Sta. Rpt. 1894, pp. 16–22*).—Analyses with reference both to mineral properties and sanitary quality of 28 samples and with reference only to sanitary quality of 7 samples are reported.

Artesian water in the western interior of Queensland, R. L. JACK (*Dept. Mines Queensland, Geol. Survey Bul. 1, pp. 16*).—This article is devoted to a discussion of the causes of artesian flow in this region.

Variations in the amount of free and albuminoid ammonia in waters on keeping, A. LIVERSIDGE (*Chem. News, 71 (1895), No. 1852, p. 219*).

Water filtration, F. FISCHER (*Ztschr. angew. Chem., 1895, No. 10, pp. 304–307, diag. 1*).—A comparison of the sand and sand-plat systems.

Amounts of air and water in the soil (*Compt. Rend., 121 (1895), No. 1, pp. 80–85; Ann. Agron., 21 (1895), No. 8, pp. 353–363; and L'Engrais, 10 (1895), No. 31, pp. 733, 734*).

On the aëration of the soil in the parks of Paris, L. MANGIN (*Compt. Rend., 120 (1895), No. 19, pp. 1065–1068*).

Concerning the causes of soil formation, K. BRUHNE (*Fühling's landw. Ztg., 44 (1895), No. 13, pp. 398–409*).

A means of determining whether or not a soil needs nitrogen, E. W. HILGARD (*Deut. landw. Presse, 22 (1895), No. 53, pp. 190, 191, figs. 2*).—The percentage of nitrogen in humus is regarded as an index.

Subsoil plowing, T. L. LYON (*Irrigation Age, 8 (1895), No. 7, pp. 209, 210*).

The importance of mud in moor culture (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 35, pp. 483–485*).

Improvement of peaty meadows by means of wood ashes (*L'Engrais, 10 (1895), No. 32, p. 759*).

Methods proposed for fixing the sands along railways in the Sahara Desert (*Abs. in Rev. Agron., 1895, No. 2, pp. 207, 208*).

Soil temperatures, J. D. CONLEY (*Wyoming Sta. Bul. 23, pp. 90, 91*).—Tabulated summaries of weekly means of observations at 6 depths (3 to 72 in.).

FERTILIZERS.

Leather refuse, its value in agriculture, J. B. LINDSEY and R. H. SMITH (*Massachusetts State Sta. Rpt. 1894, pp. 285–321, pls. 2*).—The first part of this article is a reprint of one published elsewhere and noted in an earlier number of the Record.[1] In the second part the results are reported of one year's experiments with oats grown in a series of galvanized iron pots 7¾ in. in diameter and 8 in. deep, each containing 12½ lbs. of poor subsoil. The pots were fertilized as follows:

"The sources of nitrogen were nitrate of soda, dissolved leather, and Philadelphia tankage. . . . The dissolved leather was prepared as follows: To 210 gm. of chem-

[1] Agl. Sci., 8 (1894), Nos. 2-3 (E. S. R., 6, p. 24).

ically pure sulphuric acid of 50° B., heated to 80° C., was added 63 gm. of finely ground sole leather. The mixture was thoroughly stirred and allowed to stand for half an hour; a dark pasty mass resulted. Forty-nine grams of water was added to thin the paste somewhat, and then finely ground calcium carbonate (marble) was added, to take up the excess of sulphuric acid and enable us to secure a dry, easily handled material. We used the carbonate instead of the phosphate of lime as a dryer in order to avoid an excess of phosphoric acid. After standing 24 hours the substance had dried out sufficiently to be easily handled and ground.

"Double superphosphate was used as a source of phosphoric acid, and the potash was applied in the form of the double sulphate of potash and magnesia."

Eighteen pots were used in the experiment, fertilized as follows:

Fertilizers used in the pot experiments.

Pots	Source of nitrogen.	Amount of nitrogen applied.	Amount of available phosphoric acid applied	Amount of potassium oxid applied.
		Gram	*Grams*	*Grams.*
Pots 1, 2, 3	Soil nitrogen	......	1.20	2.40
Pots 4, 5, 6	Philadelphia tankage	0.60	1.20	2.40
Pots 7, 8, 9	Nitrate of soda	.30	1.20	2.40
Pots 10, 11, 12	do	.60	1.20	2.40
Pots 13, 14, 15	Dissolved leather	.30	1.20	2.40
Pots 16, 17, 18	do	.60	1.20	2.40

"Pots 1, 4, 7, 10, 13, 16 were infected with a small quantity of cultivated soil, in order to note if the infection facilitated the nitrification of the organic nitrogen in case of our experiments. To each of these pots was also added 10 gm. of air-slacked lime."

The oats were seeded April 25, and the experiments were conducted thereafter in the usual manner. Data as to yield of dry matter in straw and grain, and nitrogen furnished in soil and fertilizer and utilized by the crop, are given for each pot.

The results indicate "that, when nitrate of soda as a source of nitrogen is rated at 100, the nitrogen in the form of dissolved leather would be rated at about 60. The return from the Philadelphia tankage was very slight. The experiment will be continued the coming year."

A comparison of phosphatic slag and nitrate of soda with ground bone on oats and corn, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1891, pp. 261-267*).—A plat of loam soil 2.8 acres in size which had been under cultivation for several years was divided into 2 parts lengthwise (north and south). One part, containing 1 acre, was fertilized with 600 lbs. of fine ground bone and 200 lbs. of muriate of potash; the remaining 1.8 acre was fertilized at the rate of 800 lbs. of phosphatic slag (odorless phosphate), 200 lbs. of muriate of potash, and 200 lbs. of nitrate of soda per acre. The plat was then divided crosswise (east and west) into plats 1 acre (0.35 acre fertilized with bone, etc., and 0.65 acre with slag, etc.) and 1.8 acre (0.65[1] acre with bone and 1.15[1] acre with slag and nitrate) in size, respectively, and the first seeded to oats, the second planted in corn.

[1] In the text stated to be 0.7 and 1.2, respectively, but this is evidently an error.

The results with both crops are summarized in the following table:

Yield of oats and corn.

	Yield per acre.	
	Plat 1 (bone, etc.).	Plat 2 (odorless phosphate, etc.).
	Pounds.	*Pounds.*
Oats (grain)	531	876
Oats (straw)	1,640	2,385
Corn	16,294	20,608

Field experiments with different commercial phosphates, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 257–261*).—The results of experiments commenced in 1890 (E. S. R., 6, p. 288) with dissolved boneblack, South Carolina phosphate, Florida phosphate, Mona guano, and phosphatic slag are briefly reported. The crops each year were as follows: 1890, potatoes; 1891, wheat; 1892, serradella; 1893, corn; 1894, barley. Data are given on the composition and cost of the phosphates, the amount of phosphoric acid applied in the fertilizer and removed in the crops, and the growth, proportion of parts, and yield of crop. "The plat receiving dissolved boneblack led in yield during the first two years, while for the third, fourth, and fifth years the plats receiving insoluble phosphates were ahead, phosphatic slag being first, South Carolina floats second, and Mona guano third."

The bacteria of stable manure and their action, E. HERFELDT (*Jour. Soc. Chem. Ind., 1895, May, p. 449; abs. in Bul. Soc. Chim. Paris, 13–14 (1895), No. 16–17, p. 1087*).—A bibliography and summary of present knowledge on this subject, under the following heads: (1) Fermentation of the fatty acids, (2) fermentation of the amid compounds, (3) putrid fermentation, (4) ammoniacal fermentation, (5) sulphohydric fermentation, (6) methanic or cellulosic fermentation, and (7) fermentation of the carbohydrates.

Plowing under green plants, VON THEUMEN (*Deut. landw. Presse, 22 (1895), No. 68, pp. 616, 617*).—A popular article in which are quoted Bässler's results, showing the advantage of turning under lupines after growth is complete rather than at earlier stages.

The influence of humus on the productiveness of soils, TANCRÉ (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 35, pp. 479–482; and Fühling's landw. Ztg., 44 (1895), No. 18, pp. 556–561*).—A review.

Recent researches on the composition and mode of action of barnyard manure, L. GRANDEAU (*Jour. Agr. Prat., 59 (1895), No. 32, pp. 181, 182*).

The utilization of the nitrogen of green manure and barnyard manure by white mustard, J. KÜHN (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 20, pp. 282–287*).

Preservation of stable manure with gypsum and superphosphate gypsum, J. SAMEK (*Tirol. landw. Blätter, 14 (1895), No. 18, pp. 158, 159*).

The loss of nitrogen in manures, G. CASTINE (*Prog. Agr. et Vit., 12 (1895), No 32, pp. 151–158*).

On the causes of the loss of nitrogen in decaying organic matter, especially in stable manure and urine (*Landw. Centbl. Posen, 23 (1895), No. 37, pp. 219, 220*).

Concerning the causes of the loss of nitrogen in fermenting organic matter (*Abs. in Fühling's landw. Ztg., 44 (1895), No. 13, pp. 409–413*).

Means of hastening the nitrification of nitrogenous substances, E. POIRET (*Belg. Hort. et Agr., 7 (1895), Nos. 8, pp. 116, 117; 9, p. 132; 10, pp. 148, 149; 11, pp. 164–166; 12, pp. 179–181; 13, pp. 196, 197; 14, pp. 211, 212; 15, pp. 227, 228; 16, p. 242*).—The conditions favoring nitrification and the use of fertilizing materials, drainage, irrigation, and thorough stirring of the soil to promote nitrification are discussed from a practical standpoint.

The discovery of potash deposits at Arnstadt (*Chem. Ztg., 19 (1895) No. 73, pp. 1623–1626*).

Pigeon manure, B. SCHULZE (*Landwirth, 31 (1895), p. 301; abs. in Chem. Ztg., 19 (1895), No. 70, Repert., p. 250*).

Pigeon manure (*Landw. Centbl. Posen, 23 (1895), No. 36, p. 215*).

Transformation of sewage into pure water and sludge (*L'Engrais, 10 (1895), No. 32, p. 758*).

Apparatus for preparing glue, oil, and fertilizer from animal products, E. REUTHER (*Ztschr. angew. Chem., 1895, No. 18, p. 558, fig. 1*).—A patented device.

Bone meal, M. MÄRCKER (*L'Engrais, 10 (1895), No. 35, p. 828*).

The manurial effect of the phosphoric acid in bone meal, STEFFEK and MÄRCKER (*Deut. landw. Presse, 22 (1895), Nos. 56, pp. 511, 512; 57, pp. 523, 524; 58, pp. 529, 530; 59, pp. 541, 542; 60, pp. 547, 548; 61, p. 557*).

On the citrate-soluble phosphoric acid in steamed bone meal, C. ANTZ (*Chem. Ztg., 19 (1895), No. 83, p. 1877*).

The activity of the phosphoric acid of sugar factory refuse, M. MÄRCKER (*L'Engrais, 10 (1895), No. 33, p. 784*).

The addition of lime to raw phosphates to increase their effectiveness, M. MÄRCKER (*L'Engrais, 10 (1895), No. 33, p. 784*).

On the application of lime and marl, ORTH (*Deut. landw. Presse, 22 (1895), No. 62, pp. 567, 568*).—A popular article.

The fertilizing value of gas lime, O. KELLNER and A. KÖHLER (*Sächs. landw. Ztschr., 43 (1895), p. 21: abs. in Chem. Ztg., 19 (1895), No. 61, Repert., p. 219*).

The valuation of Hensel's mineral fertilizer, O. BÖTTCHER (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 28, pp. 396–398*).

On the choice of phosphatic fertilizers, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 39, pp. 331–336*).

The fertilizing action of metaphosphoric acid, M. MÄRCKER (*L'Engrais, 10 (1895), No. 31, p. 735*).

The influence of phosphate fertilizers on the growth and organ formation of plants, F. NOLL (*Vortrag Bonner Gartenbau-Verein, 1895: abs. in Bot. Centbl., 63 (1895), Nos. 6–7, pp. 184, 185*).

Phosphoric acid in moor soils (*Landw. Centbl. Posen, 33 (1895), No. 30, p. 177*).

The effects of different forms of phosphate on a swamp soil, G. PAGEOT (*Jour. Agr. Prat., 59 (1895), No. 36, pp. 331–338*).—Superphosphate was effective on a humus soil shown by analysis to be poor in phosphoric acid and sulphuric acid. Thomas slag and mineral phosphates were without effect.

On a deposit of phosphate of alumina and potash found in Algeria and on the origin of these minerals, A. CARNOT (*Compt. Rend., 121 (1895), No. 3, pp. 151–155*).—An analysis of this substance is reported which shows it to contain 35.17 per cent of phosphoric acid, 18.18 per cent of alumina, and 5.8 per cent of potash. The deposit is supposed to be due to the action of the solutions infiltrating in caves containing fossils and decomposing organic matter rich in phosphates and nitrogen.

A study of the agricultural value of the phosphate of alumina of Grand Connètable, ANDOUARD (*L'Engrais, 10 (1895), No. 33, pp. 780–782*).

The phosphates of Tébessa, BEN AZOF (*L'Engrais, 10 (1895), No. 32, p. 755*).

The preparation of alkaline phosphates, R. HOLVERSCHEIT (*Ztschr. angew. Chem., 1893, No. 15, p. 462; Chem. Ztg., 19 (1895), No. 75, p. 1686*).—A patented process is described.

The actual state of the production and consumption of phosphates, D. LEVAT (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 11, pp. 602–616*).

A green manuring experiment on stiff soil, F. ZOLLIKOFER (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 35, pp. 482, 483*).

Concerning the scientific work of the Agricultural Institute at Göttingen, LIEBSCHER (*Fühling's landw. Ztg., 44 (1895), No. 18, pp. 561–568*).—An experiment on the nitrogen collected by leguminous plants and fertilizer experiments on soils differing in their content of nitrogen, phosphoric acid, and potash.

Comparative tests of the nitrogen of sulphate of ammonia and nitrate of soda, GRAHL (*L'Engrais, 10 (1895) No. 33, p. 781*).—These experiments indicated the effectiveness of the two forms to be, of nitrate of soda 100, sulphate of ammonia 90, or the same as that found by Wagner.

Field experiments comparing the values of nitrogen in sulphate of ammonia and nitrate of soda (*Mitt. deut. landw. Ges., 1895, No. 7, p. 75*).

Determination of water in commercial samples of sulphate of ammonia, J. HUGHES (*Chem. News, 72 (1895), No. 1858, p. 6*).

The ten commandments of fertilizer preparation (*Landw. Centbl. Posen, 23 (1895), No. 36, pp. 213, 214.*)

Composition of commercial fertilizers, H. B. MCDONNELL ET AL. (*Maryland Sta. Bul. 34, pp. 137–188*).—Tabulated analyses and valuations of 756 samples of fertilizing materials, accompanied by lists of fertilizers licensed for sale in Maryland for the year 1895 corrected to June 24, and a schedule of trade values of fertilizing materials. Attention is called to the fact that in the schedule of valuation adopted in this bulletin "the comparative value is $1 per ton less for each per cent of ammonia that the fertilizer contains, and 20 cts. per ton less for each per cent of potash (in the form of muriate only) than the corresponding values in the last bulletin."

Commercial fertilizers, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 324–387*).—Notes on the conduct of the fertilizer control in Massachusetts, schedule of trade values of fertilizing materials and notes on valuation, text of the State fertilizer law, instructions to dealers in fertilizers, a list of licensed manufacturers and dealers with names of brands, and tabulated analyses of 180 samples of fertilizing materials, including mixed fertilizers, bone, dissolved boneblack, Florida phosphate, sulphate of potash, sulphate of potash and magnesia, muriate of potash, wood ashes, cotton-hull ashes, limekiln ashes, coal ashes, swill ashes, nitrate of soda sulphate of ammonia, tankage, fish waste, cotton seed meal, muck, vegetable mold barnyard manure, goose manure, henhouse refuse, soot, residue from water filter refuse from calico works, hair waste, cotton waste, wool waste, waste lime, soil soil deposit, cooking soda, and baking powder.

Commercial fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Buls. 30, 31, and 32, pp. 8 each*).—Tabulated analyses of 211 samples of fertilizing materials, including mixed fertilizers, brewery refuse, oil meal, wool waste, cotton dirt, nitrate of soda, meat scrap, tankage, fish waste, blood and bone, ground bone, sulphate of potash, muriate of potash, wood ashes, cotton-hull ashes, muck, and peat. A schedule of trade values during 1895 is also given.

Compilation of analyses of fertilizing materials, C. S. CROCKER (*Massachusetts State Sta. Rpt. 1894, pp. 417–425*).—Tables show the average composition of various fertilizing materials compiled from analyses made at Amherst, Massachusetts, since 1868.

Fertilizer analyses, H. B. BATTLE (*North Carolina Sta. Special Buls. 29 and 30, pp. 4 each*).—Tabulated analyses and valuations of 87 samples of fertilizers.

Analyses of commercial fertilizers, H. J. WHEELER, B. L. HARTWELL, and C. L. SARGENT (*Rhode Island Sta. Bul. 32, pp. 21–29*).—Analyses and valuations are reported of 68 samples of fertilizing materials, including mixed fertilizers and wood ashes (18 samples). A schedule of trade values for 1895 is given, with brief notes on valuation, on the cost of mixing fertilizers, and on the comparative commercial and agricultural value of muriate and sulphate of potash.

Analyses of commercial fertilizers (*South Carolina Sta. Bul. 20, n. ser., pp. 23*).—Brief abstracts from the State fertilizer law, a schedule of trade values for the season of 1895, and tabulated analyses and valuations of 351 samples of fertilizing materials, including mixed fertilizers, acid phosphate, cotton-seed meal, nitrate of soda, sulphate of ammonia, sulphate of potash, kainit, bone, Pamunkey phosphate, and Florida soft phosphate.

Analyses of fertilizers, M. B. HARDIN (*South Carolina Sta. Rpt. 1894, pp. 12-16, 22*).—Tabulated analyses of cotton seed meal, kainit, bone, soft phosphate, phosphate rock, floats, gypsum, compost, and pea meal, with a statement of the agreement between guaranties and actual analyses made during the official inspection in 1893 and 1894.

"The table for 1894 shows that 15 of the 213 samples, or 18.52 per cent, were deficient in one or more of the fertilizing ingredients; 39 of the 132 complete fertilizers, or 29.54 per cent, were deficient in one or more ingredients; 1 of the 46 acid phosphates, or 2.17 per cent, was deficient; 3 of the 22 acid phosphates with potash, or 13.63 per cent, were below guarantee, and 2 of the 17 kainits, or 11.76 per cent, were deficient."

Fertilizer analyses, J. A. MYERS (*West Virginia Sta. Special Bul., July 1, 1895*).—This is a poster bulletin giving analyses and valuations of 139 samples of fertilizing materials, including mixed fertilizers, acid phosphates, bone, salt, and kainit.

FIELD CROPS.

Effect of time of cutting barley on color of grain, R. H. MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 35, p. 197*).—Three cuttings were made, *i. e.*, with straw mostly ripe and grain nearly all in dough state, with straw ripe and all grain in dough state, and with straw ripe and grain hard. The first cutting had grain of brightest color, weight 39.6 lbs. per bushel; the second cutting next brightest, weight 41.1 lbs.; and the third cutting darkest, weight 40.1 lbs.

Forage crops, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 231-256, 262, 263*).—The following forage plants were grown on small plats: Prickly comfrey, alfalfa, kidney vetch, flat pea, alsike clover, medium red clover, sainfoin, winter rape, dwarf Essex rape, serradella, spring vetch, Bokhara clover (*Melilotus alba*), yellow and white lupines, early and late soja beans, and silver hull, Japanese, and common buckwheat. The yields are not reported, but the results of food and fertilizer analyses are tabulated.

Food analyses of cowpeas and horse beans were made. Crimson clover, Japan clover (*Lespedeza striata*), blue lupines, winter vetch, rye, hog millet, Spanish peanuts, and corn were also grown.

The following are among the analyses made:

Food and fertilizer analyses of forage plants.

	Dry matter.	In dry matter.					Dry matter contains—		
		Ash.	Fiber	Fat.	Protein.	Nitrogen-free extract.	Nitrogen.	Phosphoric acid.	Potash.
	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.
Flat pea (*Lathyrus sylvestris*)	21.20	9.35	28.27	3.29	27.26	31.83	4.36	0.90	2.57
Late soja bean (cut August 28)	29.09	10.34	21.09	3.11	27.49	37.97	4.39	......	......
Late soja bean (cut October 28)	31.89	8.43	21.20	2.34	23.18	44.84	3.70	......	......
Early soja bean (cut August 28)	34.02	9.69	17.28	2.96	20.13	49.94	3.22	......	......
Bokhara clover (30 in. high)	12.57	11.67	24.43	3.51	23.37	37.02	3.73	......	......
Bokhara clover (36 in. high)	19.01	10.21	29.98	2.76	18.62	38.43	2.97	......	......
Bokhara clover (45 in. high, in bloom)	24.14	7.71	33.99	2.88	17.18	38.24	2.90	......	......
Kidney vetch	19.15	13.28	14.94	3.51	18.43	48.94	2.94	.44	1.75
White lupine	14.65	5.03	31.18	2.41	18.71	42.67	2.99	.35	1.73
Yellow lupine	13.95	11.14	27.10	1.87	17.84	42.05	2.66	.61	2.96
Southern cowpea	18.19	11.20	17.87	4.63	17.19	49.11	2.75	.58	1.04
Prickly comfrey	13.33	21.12	11.03	2.06	17.49	48.00	2.80	.87	5.76
Dwarf Essex rape	5.43	16.11	18.96	3.80	12.86	42.27	2.05	......	......
Winter rape	16.66	22.44	12.26	3.06	15.16	47.08	2.42	......	......

The samples for analysis were taken in the following stages of the growth of the plants: Flat pea, after pods had formed; Bokhara clover, second year from seed, May 28, June 7, and June 22; kidney vetch, second growth, in bloom; sainfoin, growth from old roots, plants cut when 30 in. high; dwarf Essex rape, 57 days after planting, 23 in. high; winter rape, 57 days after planting, about 14 in. high.

This article embraces a general discussion of the advantages of leguminous crops for forage and for renovating the soil. The roots of spring vetch, soja bean, blue lupine, and horse bean are figured.

Food and fertilizer analyses of timothy, corn stover, fodder corn, oat plants, barley plants, millet, Hungarian grass, sugar beets, ruta-bagas, mangel-wurzels, and carrots are tabulated.

A crop of vetch and oats was cut for forage in time to grow Hungarian grass on the same field in the same season.

Grasses and clover, R. L. BENNETT (*Arkansas Sta. Bul. 36, pp. 160–179*).—This is a popular discussion of the forage plants suited to different portions of the State. The principal topics treated are plants adapted to different soils, preparation of soil, sowing grass seed, management of meadows and pastures, and notes on orchard grass, Hungarian brome grass, rescue grass, timothy, Bermuda grass, Kentucky blue grass, tall fescue, tall meadow oat grass, Johnson grass, teosinte, cowpeas, red clover, crimson clover, alsike clover, Bokhara clover (*Melilotus alba*), alfalfa, Japan clover (*Lespedeza striata*), and bur clover (*Medicago maculata*).

On alluvial soil a mixture of orchard grass and red clover for permanent meadows is recommended, and either red clover, crimson clover, or Bokhara clover for temporary meadows; on sandy loam upland soil, a mixture of orchard grass, red clover, and tall meadow oat grass for

permanent meadows; red clover, crimson clover, and cowpeas for temporary meadows; and Japan clover, Hungarian brome grass, tall meadow oat grass, tall fescue, orchard grass, rescue grass, and red clover for pastures.

The author's recommendations agree in the main with those reported in Farmers' Bulletin 18 of this Department (E. S. R., 6, p. 92).

Effect of lime on yield of hay, R. H MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 35, p. 198*).—On land to which was applied 20 bu. per acre of stone lime just before planting corn the yield of corn was increased 34.7 per cent, as compared with no lime; without further applications of lime the following crop of wheat was increased 37 per cent, and the hay crop following wheat 91.3 per cent, or 1,271 lbs. per acre.

Winter oats, R. H. MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 35, p. 197*).—With seed at the rate of 2 bu. and mixed commercial fertilizers at the rate of 100 lbs. per acre a plat of Virginia winter oats yielded 31.6 bu. per acre. Sowing about September 1 is recommended in Maryland.

Potatoes, L. R. TAFT and U. P. HEDRICK (*Michigan Sta. Bul. 119, pp. 16*).

Synopsis.—Detailed data and general conclusions relative to fertilizers, fungus diseases, insect enemies, shrinkage during storage, sprouted seed tubers, removal of seed ends, selection and amount of seed, time for planting, and methods of propagating by cuttings from the stem and by true seed

One hundred and fifteen varieties were tested, but drought vitiated the results of this test and of the fertilizer experiment. The following varieties are recommended for Michigan, more particularly the lower part of the State: June Eating and Early Norther for extra early; Early Oxford, Early Ohio, Lee Favorite, Early Harvest, and Early Pearl for early; for main crop, Freeman, Nott Victor, Thorburn, Rural Blush for medium; American Wonder, President Lincoln, Rural New Yorker No. 2, Rochester Favorite, O. K. Mammoth, Summit, White Elephant, and White Prize for late.

A list of varieties which have been found worthless is given.

Potatoes stored in a barrel in a potato basement September 30, 1893, lost in weight 5 per cent by March 28 following and 11.5 per cent by May 1. Potatoes not sprouted yielded more than those which had sprouted before planting, tubers planted in the ordinary way more than those from which the seed end had been removed, and selected seed more than ordinary seed potatoes. The use of 30 bu. of seed potatoes per acre afforded a larger yield than 10 bu. of seed, but the difference in 1894 was not sufficient to compensate for the increased amount of seed.

Experiments with Philadelphia tankage and dried blood as a nitrogen source for the raising of winter grain (rye), C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 283–285*).—Data are given

for inconclusive experiments in 6 boxes, each containing 75 lbs. of earth fertilized as follows: Numbers 1 and 4, 180 gm. each of a mixture containing double superphosphate 40 parts, muriate of potash 100 parts, and dried blood 100 parts; numbers 2 and 3 the same amount of a mixture in which 100 parts of tankage was substituted for the dried blood. Two boxes received no fertilizer. A continuation of similar experiments with rape, vetch, and rye during the winter of 1894-'95, using a greater variety of fertilizer mixtures, is briefly noted.

Fertilizer experiments on soja beans, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 190-199*).—This is a continuation of the experiment recorded in the Annual Report of the station for 1893 (E. S. R., 6, p. 291), the crop, however, being changed each year. On 11 tenth acre plats, which for a number of years past had received 80 lbs. of phosphoric acid and 125 lbs. of potash together or in connection with various nitrogenous fertilizers, there were applied, in 1894, 160 lbs. of phosphoric acid and 250 lbs. of potash per acre, together or in combination with 45 lbs. of nitrogen, either as nitrate of soda, sulphate of ammonia, or dried blood. The crop in 1892 was soja beans, in 1893 oats; and in 1894 soja beans were again planted in drills at the rate of 60 lbs. per acre. The yields of forage are tabulated, but no conclusions are drawn as to the relative values of the different forms of nitrogen and potash. The plats receiving nitrogenous fertilizers yielded from 1,400 to 1,500 lbs. more per acre of forage than those not supplied with nitrogenous fertilizers, which increase, however, was not sufficient to pay the cost of the additional nitrogenous fertilizers. Doubling the quantity of mineral fertilizers used in previous years apparently had no effect on the yield.

Experiments with wheat and barley, R. H. MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 35, pp. 191-197*).

Synopsis.—Variety tests of wheat are given, Fultz and Currell Prolific appearing most promising, and comparisons of profits of growing wheat and barley, in which barley gave best results.

This is a continuation of work reported in Bulletin 28 of the station (E. S. R., 6, p. 539). Of the 22 varieties tested in 1895, Extra Early Oakley gave the largest yield per acre—42.4 bu. Currell Prolific yielded 42.3; Ruby, 41; Ontario Wonder, 39.7; Poole, 39.1, and Wyandotte Red, 38.8. The authors give precedence to Fultz and Currell Prolific. The best yields of 6 varieties for the past three years are: Fultz, 41.8 bu.; Currell Prolific, 41.5; Valley, 41.2; Badger, 40.5; Tuscan Island, 39.7, and Wisconsin Triumph, 39.6.

In a test comparing the profits of growing wheat and barley, wheat yielded 28.6 bu. per acre; winter barley, 48.4 bu., and spring barley, 26 bu. Reckoning barley at 50 cts. per bushel and wheat at 70 cts., the net profit with winter barley was $3.98 per acre more than with wheat.

Field experiments at the agricultural station of Loire-Inférieure, ANDOUARD and LETOURNEAU (*Bul. Sta. Agron. Loire-Inférieure*

1893–'94, pp. 27–45).—These included variety tests of wheat and potatoes and fertilizer experiments on cabbages used as forage. Hairy vetch at one cutting yielded 47,467 lbs. of green forage per acre containing 0.35 per cent of nitrogen, 0.17 per cent of phosphoric acid, 0.42 per cent of potash, and 0.5 per cent of lime.

The early variety of crimson clover yielded 51,243 lbs. of green forage per acre, and the late variety 58,930 lbs.

Fertilizer analyses of fresh crimson clover.

	Nitrogen	Phosphoric acid	Potash	Lime
	Per cent	*Per cent*	*Per cent*	*Per cent*
Early variety	0.46	0.12	0.43	0.50
Late variety	.42	.12	.46	.48

An early variety of barley suitable for forage, J. LAVERRIÈRE (*Jour. Agr. Prat., 59 (1895), No. 31, pp. 171, 172*).

Rumex hymenosepalus (*Curtis's Bot. Mag., table 7[illegible]*).—A figure, technical description, and popular notes are given of canaigre.

Analyses of the stems and leaves of cowpea vines, H. H. HARRINGTON (*Texas Farm and Ranch, 1895, Aug. 17, p. [illegible]*).

Report of the experiment station for flax culture and manufacture, Association of Austrian Flax and Linen Industries in Trautenau, 1894, L. LANGER (*Chem. Ztg., 19 (1895), No. 69, p. 15[illegible]*).

Mixed forage crops, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 208–212*).—The following mixtures were grown: Vetch and barley, vetch and oats, and vetch, oats, and horse bean. Determination of water in the green forage, analyses of the dry matter, and determination of the fertilizing constituents in the dry matter for all 3 mixtures are reported. The largest yields of hay were made by the mixture of vetch and oats. "Vetch, oats, and horse bean leads in nitrogenous matter." No conclusions are drawn as to the relative effects of muriate of potash and sulphate of potash tested on the mixtures.

Neurachne muelleri, E. HACKEL (*Oesterr. bot. Ztschr., 45 (1895), No. 9, p. 329*).—A description is given of a new species of grass from Australia.

A study of the meadows of the Modenese Plain, continued, L. MACCHIATI (*Staz. Sper. Agr. Ital., 28 (1895), No. 3, pp. 115–166*).—Lists of the plants most numerous in irrigated and non irrigated meadows.

Fertilizer experiments on pasture (*Agl. Students' Gaz., 1895, July, pp. 123–126*).

Fertilizer experiments on meadows, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 268, 269*).—The yields of hay on plats fertilized either with wood ashes, barnyard manure, or a mixture of ground bone and muriate of potash are given.

Varieties of oats and potatoes, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 228–230*).—Tabulated data give the yields of 3 varieties of oats and 7 of potatoes. Brief reference is made in the same connection to crops of carrots, beans, and peas grown in the same field.

Varieties of potatoes (*Rural New Yorker, 1895, Oct. 12, pp. 678, 679*).—A condensed record of a seedsman's experience.

Irish potatoes (*Florida Farmer and Fruit Grower, 1895, Sept. 28, pp. 614, 615*).—Directions for growing both the spring and fall crops in Florida.

The use of sulphate of iron as a fertilizer for potatoes (*L'Engrais, 10 (1895), No. 32, pp. 757, 758*).

Field experiments with potatoes, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 200–207*).—These experiments are in continuation of those reported in

the Annual Report of the station for 1893 (E. S. R., 6, p. 290), and consist of variety tests and a comparison of muriate and sulphate of potash. No conclusions are drawn.

The hardiness of different varieties of rye, GURADZE (*Deut. landw. Presse, 22 (1895), No. 65, p. 591*).

Variety tests of rye, N. WESTERMEIER (*Deut. landw. Presse, 22 (1895), No. 69, p. 625*).

The influence of the soil on the seed production of sugar beets, F. STROHMER, H. BRIEM, and A. STIFT (*Oesterr. Ztschr. Zuckerind. und Landw., 1895, p. 25; abs. in Ztschr. angew. Chem., 1895, No. 18, p. 549*).—The authors conclude that the influence of the soil can be noticed not only on the quantity and quality of the seed balls produced, but also on the beets raised from these seeds, as well as the first offspring of the mother beets produced.

The loss of sugar in beets during storage, STROHMER (*Oesterr. Ztschr. Zuckerind. und Landw., 24 (1895), p. 685; abs. in Chem. Ztg., 19 (1895), No. 68, Repert., p. 212*).

Does the flowering of cane influence the sugar content? H. C. P. GEERLIGS (*West Java Sugar Sta. Contr. 17, pp. 18-20*).

The condition of the sugar cane leaves as affected by wet and dry weather, J. H. WAKKER (*East Java Expt. Sta. Contr. 13, n. ser., pp. 10, pls. 2*).

Concerning evaporation in relation to the stripping of leaves from cane, F. A. F. C. WENT (*West Java Sugar Sta. Contr. 20, pp. 16*).

Variety tests of sugar cane, F. A. F. C. WENT and H. C. P. GEERLIGS (*West Java Sugar Sta. Contr. 18, pp. 49*).

Tobacco in the Congo region (*Rev. Agron., 1895, No. 2, p. 206*).—A brief note.

New South Wales tobacco in London, C. R. VALENTINE (*Agl. Gaz. N. S. Wales, 6 (1895), No. 5, pp. 361-363*).—Opinions of experts as to quality.

Tests of fertilizers on wheat, D. O. NOURSE (*Virginia Sta. Bul. 42, pp. 93-96*).—The yields for 1892, 1893, and 1894, and the average yields for 3 years are tabulated. The results are inconclusive.

Harvesting wheat in Australia and in England, C. G. ROBERTS (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 23, pp. 557-562*).—The author advocates the use of a harvesting machine to gather ears only and no straw.

Variety tests of wheat at the Chapelle (France) Experiment Station, F. DESPREZ (*Jour. Agr. Prat., 59 (1895), No. 39, pp. 445-447*).

Variety tests of winter wheat, A. SEMPOLOWSKY (*Deut. landw. Presse, 22 (1895), No. 63, p. 576*).

Rotation of crops and farm management, E. KLAPPER (*Fühling's landw. Ztg., 44 (1895), No. 18, pp. 568-579*).—Examples of German rotations, and figures bearing on the relative profits from sheep and cattle.

Rotation of crops, J. L. THOMPSON (*Agl. Gaz. N. S. Wales, 6 (1895), No. 7, pp. 479-486*).

Agricultural suggestions to the Waldensians, W. F. MASSEY (*North Carolina Sta. Special Bul. 28, pp. 25*).—The principal topics treated in a popular manner are plows and plowing, rotation of crops, the growing of wheat, corn, Irish potatoes, sweet potatoes, cabbages, and turnips, and the care of manure. A translation of this bulletin into French is incorporated.

HORTICULTURE.

Forcing lettuce in pots (*New York State Sta. Bul. 88, n. ser., pp. 133-138, pl. 1*).—Description of methods followed at the station in raising lettuce during the winter in pots under glass. The plants were started in plats and transplanted to 2-in. pots when about 2 in. high. These pots contained a mixture of clay loam, barnyard manure, and sand, and were sunk half an inch deep in the soil in greenhouse

benches as soon as the plants were placed in them. The soil in the benches was the same as that in the pots, 3 in. deep, with a 3-in. layer of barnyard manure beneath it. The majority of the varieties tested grew well and produced fine heads. The temperature ranged from 50 to 60° during the day and 45 to 50° during the night, with ample ventilation. It is advised that when subirrigation is not employed the plants should be watered only early in the morning on sunny days, that the water may quickly dry from the leaves. Frequent dusting the under surface of the leaves with tobacco dust was employed to prevent attacks of the aphis. When the heads were full grown they were marketed by knocking the masses of roots out of the pots and wrapping them snugly in oiled paper, by which means the plants remained fresh for some time.

Descriptive notes are given on the following varieties, which gave the most success in forcing at the station: Big Boston, Salamander, Drumhead, Henderson New York, Golden Ball, Golden Queen, Grand Rapids, Hanson, New Iceberg, and Prize Head.

Mushrooms as a greenhouse crop (*New York State Sta. Bul. 88, n. ser., pp. 139–151, pl. 1*).—This contains the results of experiments at the station with growing mushrooms in beds situated under the center benches of the greenhouses. The particulars of the experiment are given at length and detailed directions furnished for the growing of mushrooms. The temperature of the house varied from 55° at night to 70° in the day. The beds were made of fresh horse manure mixed with loam, which was laid on the boards forming the bottom of the beds and pounded to make it firm. In the top of this manure the pieces of spawn were inserted an inch below the surface, and 2 weeks later, when the spawn began to spread, the tops of the beds were covered 2 in. deep with fine mellow loam, over which was laid 2 or 3 in. of excelsior to prevent too rapid drying of the soil. The soil was syringed with water at 100° whenever it commenced to look dry, and after the beds began to bear a solution of nitrate of soda was supplied for watering. A hot-water pipe passed near a portion of the bed, but mushrooms grew successfully near it in spite of the increased warmth. It is advised that the mushrooms be gathered as soon as the cap expands and while the gills are yet pink, and sorted into different sizes for market. Illustrations are given of the mushroom beds and of the mushrooms in different stages of growth.

A few recipes are appended for preparing mushrooms for the table, and the following analysis, made at the station, is given of mushrooms:

Analysis of mushrooms.

	Mature.	Buttons.
	Per cent.	*Per cent.*
Moisture	91.80	90.33
Dry matter	8.20	9.67
In dry matter		
Ash	12.87	11.96
Total nitrogen	9.43	9.30
Albuminoid nitrogen	5.01	5.34
Albuminoids	31.31	33.38
Fat	3.72	3.19

Vegetable novelties and notions, L. R. TAFT, H. P. GLADDEN, and U. P. HEDRICK (*Michigan Sta. Bul. 120, pp. 17-28*).—There were grown 26 varieties of bush beans, 15 of pole beans, 12 of beets, 51 of cabbages, 11 of cauliflower, several of cucumbers, 14 of onions, 40 of peas, 20 of sweet corn, and 105 of tomatoes. Descriptive notes and tabulated data are given for a part of these.

An experiment with subirrigating celery proved successful and the method is strongly advocated.

The following varieties are recommended: *Bush beans*—Cylinder Black Wax, Butter Wax, Mammoth Wax, Red Valentine, Shah, and Flageolet Victoria; *pole beans*—Black Lima, Golden Champion, and Golden Cluster; *beets*—Eclipse, Half long Blood, and Long Blood; *cucumbers*—for pickling, Siberian, Westfield, and Parisian Prolific; for table use, White Spine, Green Prolific, Long Green, Japanese Climbing, and Albino; *onions*—Red Wethersfield, Yellow Danvers, and Southport White Globe; *peas*—Melting Sugar, Tall Sugar, Mammoth Sugar, and Dwarf Sugar; *sweet corn*—first early, Early Vermont, White Cob Cory, First of All; second early, Early Champion, Leet Early; medium, Hickox Hybrid, Landreth; late, Country Gentleman, Zigzag, Stowell Evergreen; *tomatoes*—Earliest, Advance, Ignotum, Acme, Optimus, and Trophy.

Field experiments to ascertain the influence of different mixtures of commercial fertilizers on the yield and general character of several prominent garden crops, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1891, pp. 213-227*).—This deals with the continuance of fertilizer experiments begun in 1891 to test the relative value of various forms of nitrogen and potash, dried blood, nitrate of soda, sulphate of ammonia, muriate of potash, and sulphate of potash being used in the experiment. In all cases the phosphoric acid used in the fertilizers was supplied by means of dissolved boneblack. The same proportionate amount of nitrogen, potash, and phosphoric acid was applied in each instance.

The conclusions for the past 3 years indicate that the best results are obtained when the potash is applied in the form of sulphate, and nitrogen in the form of nitrate of soda.

Tables are given showing the yield per plat of the several vegetables grown, and analyses are given showing the composition and fertilizing constituents of each vegetable.

Observations with different forms of potash, phosphoric acid and nitrogen on garden crops, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1891, pp. 273-282*).—This is a report on box fertilizing experiments conducted with various vegetables during the winters of 1893-'94 and 1894-'95. During the first winter 12 boxes were filled with 300 lbs. each of a light unmanured loam and each planted with Hanson lettuce, New Zealand spinach, Egyptian beets, and Essex Hybrid tomatoes. The fertilizers applied to the majority of these boxes contained potassium oxid 0.0004 per cent, phosphoric acid 0.0001 per cent, and nitrogen 0.0001 per cent, supplied by different combinations of commercial chemical fertilizers. The box fertilized with 136 gm. of double superphosphate, 360 gm. of carbonate of potash magnesia, and 106 gm. of nitrate of soda produced the best results with all the vegetables except beets. A slightly superior result with beets was obtained in a box in which the superphosphate was replaced by 106 gm. of dissolved boneblack.

The second winter 16 larger boxes were employed, each holding 750 lbs. of earth. To 8 of these boxes the proportion of fertilizing ingredients applied was as follows: Potassium oxid 0.0056 per cent, phosphoric acid 0.0014 per cent, and nitrogen 0.0014 per cent. To the remaining 6 boxes 0.0056 per cent of phosphoric acid was supplied. The vegetables employed in the experiment were Lorillard tomato, Early American Redtop turnip, and Rawson New Hothouse lettuce. The experiment was not completed at the time of writing this progress report.

The apple orchard, L. R. TAFT (*Michigan Sta. Bul. 121, pp. 25-48, figs. 5*).—This is a popular bulletin on the subject of apple culture, the soil, drainage, selection and planting of trees, propagating, cultivating, pruning, fertilizing, varieties, insects and diseases and remedies being treated of at more or less length. The history of the apple is briefly mentioned and its introduction and development in America noted. The cause of recent failures of the apple crop in Michigan is discussed, and it is believed to be due to the too frequent custom of allowing the orchards to grow up in sod, combined with careless methods of pruning, neglect to fertilize, and cold rains in the spring just as the foliage and buds are appearing. It is stated that the apples grown in Michigan compare favorably with those from other parts of the United States in size, color, flavor, and keeping qualities. The best part of the State for apple growing is in the counties bordering on the shore of Lake Michigan, where the soil is new and fertile and the spring somewhat

backward, so that the foliage, being slow in starting, is not apt to be caught by late frosts. It is given as a general rule that apples will do well on any high, strong, well-drained soil that will grow good wheat or corn, but, though extremes should be avoided, sandy loams and clay loams will often prove satisfactory also. Good drainage is insisted upon, either natural or else by 3-in. tile laid at a depth of about 4 ft. between the rows of trees. It is urged that before planting to trees a previous crop should be grown and well manured, and where possible clover should be seeded and turned under before setting out the trees. The plowing should be deep. Two-year trees 5 to 7 ft. high with ¾-in. stems are recommended as the best size to plant in general, and directions are given for selecting and planting, which it is preferred should be done in the fall. It is recommended to plant the strong-growing, long-lived varieties 40 ft. apart, while smaller trees may be grown without crowding at shorter distances. Squares or triangles are recommended and figured as being good arrangements for planting, but hexagons of early fruiting small trees, with a large, slower bearing tree in the center, are also advocated.

Directions are given for carrying out the usual methods of propagating, root grafting being preferred and described at most length. Top working is advised in the case of weak-growing varieties. The following varieties are selected as a list to be planted for family use, including dessert, cooking, and sweet apples for the different seasons: Red Astrachan, Bough (sweet), Oldenburgh, Primate, Chenango, Keswick, Maiden Blush, Shiawassee, Twenty Ounce, Bailey (sweet), Westfield, Jonathan, Hubbardston, Grimes, Baldwin, Talman, King, Rhode Island Greening, Red Canada, Northern Spy, and Golden Russet. For commercial planting it is recommended that fewer varieties be grown and that they consist chiefly of winter sorts. Descriptive notes are given on the 21 varieties recommended for family use. Directions are given for pruning and heading the trees, it being urged that dead branches be removed on their appearance, the head kept open to admit air and allow easy fruit gathering, the head pruned to a symmetrical shape, and that the heads be formed low. It is advised to grow some hoed crop in the young orchards, so that the soil may be cultivated up to August. A growth of rye during the summer, to be turned under in May, is recommended as serving for winter protection and adding to the soil humus. The growing of grass in orchards is strongly discouraged.

Until the trees reach a bearing age, from 15 to 20 loads of barnyard manure per acre applied broadcast every 2 years is recommended, to be replaced after the trees reach a fruiting age by chemical manures, such as supply potash and phosphoric acid being chiefly employed. Wood ashes or the German potash salts are recommended for supplying potash, and ground bone or dissolved South Carolina rock phosphate for phosphoric acid. If nitrogenous manures appear to be needed, nitrate of soda and barnyard manure may be sparingly applied.

For the renovation of old orchards the following recommendations are made: Cutting down old trees with decayed trunks, removing dead or dying branches from such trees as have healthy trunks, supplying well-rotted barnyard manure and wood ashes to worn-out land and following this by cultivation, scraping the thick dead barks of old tree trunks and then washing with dilute soft soap and thorough spraying for insects and fungus diseases.

For remedies against the cankerworm, codling moth, bud moth, and apple scab several applications of Bordeaux mixture and Paris green are urged and a calendar given for the times for spraying. Directions are given for preparing white arsenic with lime as a cheap substitute for Paris green, and the State law making spraying compulsory is quoted.

Russian cherries, U. P. HEDRICK (*Michigan Sta. Bul. 123, pp. 22-24*).—A brief general account of Russian cherries, with favorable remarks on their growth at the station and recommendations for their cultivation in the northern part of the State. The following summary is given by the writer:

"(1) The introduction of Russian cherries in the United States dates from 1882, when Professor Budd, of Iowa, and Charles Gibb, of Canada, imported a number of varieties from Russia.

"(2) Russian cherries are recommended for those localities in Michigan which are too cold for the common cherries. They are for these regions a good substitute for common cherries. Since they ripen very late, they may for this reason find favor with the general grower.

"(3) The chief characteristics of the Russian cherries are: A dwarf, compact habit of growth; small narrow leaves, which are thick and finely textured; a deep purplish-red, or reddish-black fruit, and a peculiar astringent flavor which is often very pleasant; leaves and flowers appear later and the fruit ripens later than those of the common cherries.

"(4) The following varieties do best on the station grounds: Bessarabian, very hardy and prolific; Brusseler Braune, fruit large, tree vigorous and prolific; Ostheim, one of the best known of the Russian cherries."

Native plums, U. P. HEDRICK (*Michigan Sta. Bul. 123, pp. 17-21*).—Popular notes on the character, cultivation, propagation, and value of the varieties of native plums. The station orchard contains 80 trees representing 35 varieties, growing on a well-drained clay loam. Almost any soil, except extremely sandy or heavy clay, is believed to be adapted for the native plum, and it is thought that most of the plums will grow in all parts of the State, except the extreme northern portions. It is urged that in planting out the orchards care should be taken to employ mixed planting to insure the fertilization of such varieties as are self-sterile. Marianna and myrobalan stocks are recommended for propagating, the methods of planting and cultivating not differing from those employed with the common European varieties.

The most valuable of the 150 native varieties are believed to have come from the species *Prunus americana*, *P. hortulana*, and *P. angustifolia*. The native plums are recommended on account of their earliness,

great variety, and immunity from diseases and insects. The following varieties are believed to be most valuable: De Soto, Rollingstone, Weaver, Wild Goose, Miner, and Newman. Seventeen varieties are described.

Fertilizer experiments with orchard fruits, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1891, pp. 270–273*).—This is a preliminary report upon experiments with fertilizing different plats of apples, pears, peaches, and plums with different fertilizers. Five plats are being employed in the experiment, 1 being left unmanured as a check, while to the others are applied, respectively, barnyard manure, wood ashes, ground bone, and muriate of potash, and ground bone and sulphate of potash and magnesia. The fertilizer is applied as a top dressing in the spring or fall. Cultivated crops are annually grown between the rows of trees. The experiment, which was begun in 1889, will be continued for several years.

Seedling strawberries, C. A. KEFFER (*Missouri Sta. Bul. 22, pp. 11*).—Notes on a series of experiments with seedlings from Gandy, Bubach No. 5, Crescent, Lady Rusk, and Warfield No. 2. No attempt had been made to cross fertilize the flowers from which these seedlings were produced, and so only the female parent was known. However, as the plants were in a plantation of about 100 varieties, the male parentage was probably quite mixed. Both perfect and pistillate plants were produced among the seedlings of each variety, the condition of the parent being duplicated in a majority of the seedlings. There was a strong tendency to reproduce certain marked characteristics of the parent, but as a rule there was considerable variation. Some of the new varieties seemed to be superior to the old from which they came, and were selected for further testing in the future. Tabulated data are given for 245 of the seedlings, and the same points of the parents cited for comparison.

Small fruit notes, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Bul. 122, pp. 14*).—This contains elaborate descriptive notes and tabulated data on tests of numerous varieties of strawberries and raspberries, 139 varieties of strawberries having been grown, 25 varieties of black and 20 varieties of red raspberries. The yields from 40-ft. rows each of 15 varieties of strawberries were compared, Afton leading with a yield of 16¾ qt., followed by No. 4 (J. S.) and Bird, bearing 16¼ and 15¾ qt., respectively.

Grape culture, C. A. KEFFER (*Missouri Sta. Bul. 23, pp. 27, figs. 9*).—An illustrated popular article on the proper care of grapevines and vineyards. Instructions are given for the selection of varieties, planting, cultivation, pruning, training, renewing, spraying, and bagging. Especial stress is laid on training, and the following systems are described and clearly figured: Long arm and short spur, horizontal cordon, low renewal, high renewal, Kniffen, and Munson. Formulas are given for Bordeaux and carbonates of copper and ammonia mixtures,

The following varieties are recommended for Missouri: *Black*—Moore Early, Worden, Potter, Concord, Eaton, Black Defiance; *white*—Jessica, Elvira, Hayes, Moore Diamond, Empire State; *red and amber*—Delaware, Brighton, Wyoming Red, Ideal, Jefferson, Goethe.

The main points are summarized as follows:

"With few exceptions grapes of the Labrusca species, of which Concord may be taken as the type, are the most satisfactory for general planting.

"A warm, rich, well-drained soil is best for the grape.

"Almost all vines should be planted at least 8 ft. apart. . . .

"Strong 1-year-old vines are most desirable for planting.

"Thorough shallow cultivation is essential. . . .

"The pruning of the first two years must be done with reference to the system under which the vine is to be trained after it begins fruiting. During this time the vine should become thoroughly established.

"The best time for the principal pruning is soon after the leaves drop in autumn, but pruning can be done at any time during the winter when the vines are not frozen. Summer pruning consists in pinching lateral branches in order to encourage the development of the fruit and the bearing wood for the succeeding year

"The long arm, short spur system of training is usually the most satisfactory for the inexperienced grower, but the renewal systems are highly recommended.

"The most satisfactory way to bring a neglected vine into vigorous growth is to cut the vine off at the ground, and train the shoots that will spring from the stub on one of the renewal systems. . . .

"The principal diseases of the grape are powdery mildew and black rot, both of which can be controlled by spraying with Bordeaux mixture. . . .

"Bagging the grapes as soon as the bloom has fallen will prevent rot, and the fruit is more beautiful when grown in bags."

Horticultural experiments (*Thirteenth Rpt. Technical Education Committee, Kent, England, 1895, pp. 26-45*).—These consist mainly of fertilizer experiments with strawberries, potatoes, beans, peas, dwarf beans, and scarlet runners. In all of the experiments irregular fertility of the soil produced confusing results, but the general indication was that the use of chemical fertilizers was beneficial. Strawberries produced the largest yields when littered with straw and top-dressed with nitrate of soda. An experiment in spraying potatoes with a solution of copper sulphate and sodium carbonate produced healthy, thrifty foliage, while unsprayed plants lost their leaves early.

To prevent the attack of fruit trees by the caterpillars of the mottled umber moth (*Hybernia defoliaria*) and the winter moth (*Cheimatobia brumata*) various fruit trees and nut bushes were banded with grease mixtures. It was found that a band 9 in. in width was effective in checking the ascent of the female moth.

Preservation of fruits in chemical fluids for museum purposes, W. SAUNDERS (*Trans. Roy. Soc. Canada, 1891, pp. 115, 116*).—Brief notes on some experiments with various solutions for the preserving of fruits in their natural colors and forms. Kerosene is preferred for preserving strawberries; a 1 or 2 per cent aqueous solution of boric acid for red and black cherries, currants, and other dark fruits; a 2 per cent aqueous solution of zinc chlorid for light-colored fruits, and a

solution of salicylic acid for dark-colored grapes. For brightening up and bleaching discolored specimens of white or yellow fruits sulphurous acid, 4 oz. to a gallon of fluid, was found a useful addition.

Report of horticulturist, J. F. C. DU PRE (*South Carolina Sta. Rpt. 1894, pp. 28–32*).—A popular report on the work of the year, experiments with various garden vegetables, Irish potatoes, and melons being especially undertaken. The station has equipped a small cannery, where the crop of tomatoes has been canned.

Casabanana (Benincasa cerifera), J. L. NORMAND (*Texas Farm and Ranch, 1895, Sept. 21, p. 10*).—Notes on the wax gourd as grown in Louisiana.

Edible and poisonous mushrooms, with atlas, J. COSTANTIN and L. DUFOUR (*Petite flore des champignons comestibles et veneneux. Paris: Paul Dupont, 1895*).

Mushrooms considered in their bearing on medicine, L. M. GAUTIER (*Les champignons considérés dans leurs rapports avec la médecine. Paris: J. B. Baillière et fils, pp. 508, pls. 16, figs. 195*).

Truffles of Cyprus, Smyrna, and La Calle, A. CHATIN (*Compt. Rend., 121 (1895), No. 9, pp. 367–370*).—Descriptions and notes are given of *Terfezia claveryi* and *T. leonis.*

The preservation of vegetables, L. R. TAFT (*Amer. Agr. (middle ed.), 1895, Oct. 19, p. 330*).—Directions for keeping roots, onions, squashes, sweet potatoes, celery, cabbages, and potatoes.

Cold storage and preservation of fruit from an engineer's point of view, N. SELFE (*Jour. Council of Agr. Tasmania, 1895, July, pp. 68–71*).—A popular article in the nature of a review, with suggestions.

Concerning the guava of Sardinia, F. SESTINI (*Staz. Sper. Agr. Ital., 28 (1895), No. 6, pp. 383–389*).

Peaches and other fruits in England (*U. S. Dept. Agr., Section of Foreign Markets Circ. 1, pp. 2*).—A brief report on peaches, nectarines, and pears in English markets, with recommendations for gathering, varieties, and packing of fruits to be sent from America to England. It is believed that choice fruit, if well packed, will obtain a satisfactory market in England.

The Russian tree fruits in America, I, II, and III, T. H. HOSKINS (*Garden and Forest, 8 (1895), Nos. 380, p. 226; 381, p. 236; 382, p. 246*).—The first article deals with the history of the introduction of Russian apples, first made about 1870, Tetofsky, Duchess of Oldenburgh, and Red Astrachan being the varieties imported; the second with their development in America and adaptability for the Northern States; and the third with the successful growth of pears in America.

Notes for amateur fruit growers, F. M. BAILEY (*Queensland Dept. Agr. Bul. 5, ser. 2, pp. 32, figs. 8*).—These consist of various popular cultural and botanical notes on orchard and small fruits and grapes, to which is appended a list of fruit-bearing plants that have been introduced into the colony.

Fruit from the orchard to the buyer, L. G. CORRIE (*Agl. Gaz. N. S. Wales, 6 (1895), No. 7, pp. 465–478*).—Directions for gathering and packing.

The Woburn experimental fruit farm (*Agl. Students' Gaz., 1895, July, pp. 145, 146; and Nature, 52 (1895), No. 1351, pp. 508–510*).—A report is given of the progress made at this station in the study of horticulture, especially as applied to hardy fruits.

The Logan blackberry (*Meehan's Monthly, 5 (1895), No. 9, p. 176*).—The ripening in the vicinity of Philadelphia of a few berries of this new fruit is mentioned. The canes are liable to winterkilling and should be covered during the winter.

A study of strawberries, S. B. HEIGES (*Rpt. Pa. Bd. Agr. 1894, pp. 207–212*).—Notes on varieties grown on the grounds of the United States Department of Agriculture in 1894.

On the use of hybrids in the restoration of the vineyards of Jura, J. ROY-CHEVRIER (*Prog. Agr. et Vit., 12 (1895), No. 38, pp. 311–316*).

Pruning grapevines, G. C. BUTZ (*Rpt. Pa. State Bd. Agr. 1894, pp. 226–232, figs. 6*).

Budding of grapevines, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 23, pp. 597–600*).

Budding as applied to the vineyard, P. CAHUZAC (*Le greffé en écusson appliquée a la vignoble. Marseilles: P. Blanc, pere, 1895, pp. 65*).—A practical guide to the grafting of vines by budding.

Concerning grapes resistant to black rot, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895) No. 38, pp. 307–310*).

The best five grapes for Kansas, S. C. MASON (*Kansas State Bd. Agr. Rpt. 1895, pp. 141–144*).—The varieties Concord, Worden, Hayes, Etta, and Woodruff are recommended, and directions are given for the cultivation, training, and pruning of grapevines.

Grapes for South Texas, H. M. STRINGFELLOW (*Texas Farm and Ranch, 1895, Sept. 21, p. 10*).—Notes on suitable varieties.

The symbiosis of stock and graft, H. VÖCHTING (*Abs. by E. F. Smith in Amer. Nat., 1895, July, pp. 615–621*).—Among the plants grafted were beets, potatoes, and tomatoes. The conclusion is reached that either there are no such things as graft hybrids, or else they are limited to a small number of plants.

Carnation culture (*Rural New Yorker, 1895, Oct. 12, pp. 680, 681*).—A brief outline of the culture of carnations in Pennsylvania, with notes on the kind of greenhouse desirable.

A chart of the correct colors of flowers, F. S. MATTHEWS (*Suppl. Amer. Florist, 1895, Aug. 17, opposite p. 34*).—The representation of 36 colors and shades.

Practical dictionary of horticulture and gardening, G. NICHOLSON (*Dictionaire pratique d'Horticulture et de Jardinage. Paris: O. Doin, 1895. Edited, in French, by Mottet and others*).

DISEASES OF PLANTS.

Spraying for the prevention of fungus diseases, J. CRAIG (*Canada Central Exptl. Farm Bul. 23, pp. 1–17, figs. 2, pls. 2*).—The author gives popular information relative to various fungus diseases and suggests methods for their prevention. Formulas are given for various spraying mixtures and different forms of spraying apparatus are described. During the past year experiments were conducted on peaches, plums, cherries, pears, and apples to determine the extent to which the diseases were prevented, and the profits from spraying. In every case the diseases were less prevalent upon the sprayed than the unsprayed trees.

In the case of the peaches the sprayed trees showed 3 to 4 per cent less rotten fruit than the unsprayed.

In the case of the plum trees treated the fruit on the sprayed trees was considerably larger than on the checks and could readily be sold as first-class fruit, while that from the unsprayed trees could hardly be classed as "seconds."

In the case of the cherry trees treated there was 3 times as much fruit picked from the sprayed tree as from the unsprayed one. In another case a selected sprayed tree yielded 130 lbs. of fruit which netted \$9.25, while a selected unsprayed tree of about equal size yielded 17 lbs. of fruit which netted but \$1.20.

The pear trees which were sprayed for the leaf blight and cracking and spotting of fruits yielded 75 per cent more marketable fruit than the unsprayed ones.

Sprayed apple trees yielded 24 per cent more first-class fruit, 6 per cent less second-class fruit, and 18 per cent less third-class fruit than the same number of unsprayed trees.

The author also gives a spraying calendar which combines treatment for the prevention of insect and fungus attacks.

The pests of the orchard and garden, L. R. TAFT and G. C. DAVIS (*Michigan Sta. Bul. 121, pp. 77, figs. 69*).—A popular compiled bulletin, containing information in regard to the action and use of fungicides and insecticides, with formulas for their preparation, and a tabulated spraying calendar. A general life history of fungus diseases is given and the habits and transformations of insects briefly discussed. The bulk of the bulletin consists of illustrated descriptive and remedial notes on the insects and diseases of the apple, peach, pear, cherry, plum, quince, grape, strawberry, raspberry, blackberry, currant, gooseberry, cabbage, cucumber, squash, pea, bean, and tomato. In conclusion is given an illustrated description and discussion of various forms of spraying apparatus.

Spraying apple trees for fungus and insect pests, C. A. KEFFER (*Missouri Sta. Bul. 27, pp. 24, fig. 1*).—Experiments were conducted in 4 orchards on the prevention of fungus diseases and insect attacks with strengths of Bordeaux mixture varying from 2 to 6 lbs. copper sulphate to 50 gal. of water, to which was added 2 oz. of Paris green per barrel. The trees were given 3 or 4 applications of the fungicide. The author's summary shows that 4 applications were more efficacious than 3; that the weaker solutions seemed about as effective as the stronger; that apple scab was largely checked; that a second crop of scab was entirely prevented and the first crop nearly so; and that the addition of Paris green had no appreciable effect in diminishing the injury by the codling moth.

These results were obtained in a very dry season and might have been modified had there been the usual amount of rainfall. The results in the 4 orchards were not entirely parallel, but the summary applied in somewhat varying degree to each.

The vegetable parasites of useful cultivated plants, A. N. BERLESE (*I parassiti vegetali delle piante coltivate utili. Milan: F. Vallardi, 1895, pp. 216*).

On a remarkable appearance of Nectria cinnabarina and the manner of the propagation of the fungus, J. BEHRENS (*Ztschr. Pflanzenkrank., 5 (1895), No. 4, pp. 193–198*).

Concerning the promotion of fungus spore germination through cold, J. ERICKSSON (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 15–16, pp. 557–565, fig. 1*).

Recent investigations concerning Phoma betæ, FRANK (*Ztschr. deut. Ver. Rubenzuckerind., 1895, pp. 157, 271; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 15–16, pp. 592–596*).

Observations on Phoma betæ, E. J. MCWEENEY (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 23, pp. 563–568, figs. 9*).

Concerning the vegetable parasites of the sugar beet, A. STIFT (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 13–14, pp. 489–497*).

On the spread of the root disease of sugar cane, F. A. F. C. WENT (*West Java Sugar Sta. Contr. 20, pp. 18–21, pl. 1*).

A disease of sugar cane due to Marasmius sacchari n. sp., J. H. WAKKER (*East Java Expt. Sta. Contr. 16, n. ser., pp. 15, figs. 5*).

A disease of sugar cane caused by Coniothyrium melasporum, PRILLIEUX and DELACROIX (*Rev. Agr. Île Maurice, 9 (1895), No. 7, pp. 166–169*).

Is the ability to withstand rust constant or not? J. ERICKSSON (*Ztschr. Pflanzenkrank., 5 (1895), No. 4, pp. 198–200*).

Bacillus tracheiphilus, n. sp., a cause of wilting in various cucurbits, E. F. SMITH (*Centbl. Bakt. und. Par. Allg., 1 (1895), No. 9 and 10, pp. 364–374*).—A description and biology of a bacterial disease of cucurbits. The bacillus is found in the larger vessels of the xylem.

An unusual appearance of Ascochyta pisi upon peas, F. KRÜGER (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 17, pp. 620–624*).

Disease of pepper plants, G. MASSEE (*Kew Misc. Bul. 104, pp. 178–180*).—An account is given of the ravages of *Dematophora necatrix* on the black pepper in India. The prompt burning of all diseased plants is advised as the only relief.

Potato diseases, J. FLETCHER (*Canada Central Exptl. Farm Bul. 23, pp. 24–27, figs. 2*).—The author reports upon the early and late blights of potatoes, for which applications of Bordeaux mixture are recommended, and upon potato scab, recommending that the seed tubers be treated with corrosive sublimate solution.

Report on an investigation into the potato diseases prevalent in the Clarence River District (N. S. Wales), R. HELMS (*Agl. Gaz. N. S. Wales, 6 (1895), No. 5, pp. 316–333, pls. 2*).—The disease treated at most length is "wet rot," which the author ascribes to the action of *Bacillus amylobacter*.

Potato blight and the means of combating it, W. HESS (*Fühling's landw. Ztg., 44 (1895), No. 17, pp. 521–527*).

Treatment of a fungus disease of tomatoes, N. SCHNEIDER (*Rev. Hort., 67 (1895), No. 18, pp. 431–437*).

Black knot of plum and cherry, J. CRAIG (*Canada Central Exptl. Farm Bul. 23, pp. 22–24, figs. 4*).—The author gives compiled information relative to the attack of the plum and cherry by the fungus *Plowrightia morbosa*. The information was compiled largely from New York State Station Bulletin 40 (E. S. R., 1, p. 55), New Jersey Station Bulletin 78 (E. S. R., 2, p. 501), and New York Cornell Station Bulletin 81 (E. S. R., 6, p. 908). The Ontario act passed in 1893 relative to peach yellows and black knot is briefly quoted.

The sclerotium disease of Prunus padus and Sorbus aucuparia, M. WORONIN (*Mem. Imper. Acad. St. Petersburg, ser. 8, 2 (1895), No. 1, pp. 28; abs. in Bot. Centbl., 63 (1895), No. 4–5, pp. 145, 146; also Ztschr. Pflanzenkrank., 5 (1895), No. 4, pp. 236–240, pl. 1*).—The author describes *Sclerotinia padi* and *S. aucuparia*.

Mildew and black rot, A. CARRE (*Prog. Agr. et Vit., 12 (1895), No. 30, pp. 89–93*).

Report on black rot of grapes in the Department of Aveyron in 1894, G. LAVERGNE (*Bul. Min. Agr. France, 14 (1895), No. 2, pp. 166–171*).

La Maromba a grape disease of Portugal (*Prog. Agr. et Vit., 12 (1895), No. 38, pp. 320–323*).

Concerning the yeast and mildew fungi of grapes, H. ECKENROTH and R. HEIMANN (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 15–16, pp. 529–536, figs. 6*).

Begonia rust (*Gard. Chron., ser. 3, 18 (1895), No. 456, p. 337*).—A disease of begonias supposedly due to a fungus assisted by poor ventilation is briefly mentioned and flowers of sulphur recommended for its prevention.

The carnation rust (*Meehan's Monthly, 5 (1895), No. 9, pp. 169, 170, fig. 1*).—Brief illustrated notes are given of *Uromyces caryophyllinus*.

Concerning hexenbesens on Prunus pseudo-cerasus, M. SHIRAI (*Bot. Mag. Tokyo, 9 (1895), p. 81; abs. in Hedwigia, 34 (1895), No. 4, Repert., p. 117*).—The author states that the trouble is due to *Taphrina pseudo-cerasus*.

Combating cane diseases, J. H. WAKKER (*East Java Expt. Sta. Contr. 4, n. ser., pp. 27–39*).

Black rot and the salts of copper, L. DEGRULLY (*Prog. Agr. et Vit.*, *12* (*1895*), *No. 30*, *pp. 81–88*).

Destruction of microörganisms by formol, F. JEAN (*Ind. Lait.*, *20* (*1895*), *No. 25*, *pp. 209–211*, *fig. 1*).

Contribution to the knowledge of combating the Sarcina disease (*Ztschr. ges. Brauw.*, *18* (*1895*), *Nos. 8–10*; *also Centbl. Bakt. und Par. Allg.*, *1* (*1895*), *No. 17*, *pp. 641, 642*).

Age of Bordeaux mixture, G. H. POWELL (*Garden and Forest*, *8* (*1895*), *No. 395*, *p. 378*).—The author states that Bordeaux mixture that has been prepared a long time precipitates more readily than fresh, hence must be agitated more. Experiments on potatoes showed it possible to apply the mixture well at the beginning, but through precipitation the last of the plat would get no copper or lime, the earlier application having exhausted them.

A new method of using the potassium ferrocyanid test, E. G. LODEMAN (*Garden and Forest*, *8* (*1895*), *No. 391*, *p. 336*).—The author advocates dropping the Bordeaux mixture into the potassium ferrocyanid solution. When enough lime is present the solution will not show any change. It is best to use this in a shallow dish or saucer to better see the effect.

ENTOMOLOGY.

The army worm, L. O. HOWARD (*U. S. Dept. Agr.*, *Division of Entomology Circ. 4*, *pp. 5*, *figs. 3*).—A brief general and popular illustrated account of *Leucania unipuncta*, giving the life history, habits, remedies, and natural enemies. Rotation of crops, clean cultivation, and winter burning of infested fields are recommended, but it is believed that invasions of the insect will be speedily checked by the numerous insect parasites preying upon it, one of which, the red-tailed tachina fly (*Nemoræa leucaniæ*), is described and figured.

The carpet beetle, L. O. HOWARD (*U. S. Dept. Agr.*, *Division of Entomology Circ. 5*, *pp. 4*, *fig. 1*).—A brief general and popular illustrated account of *Anthrenus scrophulariæ*, giving the life history, habits, and remedies. It is stated that when this insect has once taken possession of a house it is very difficult to eradicate. Carpets should be taken up, thoroughly beaten, and sprayed with benzine. The rooms should be thoroughly cleaned, and kerosene or benzine poured into the cracks of the floors and under the base boards. It is also suggested that tarred roofing paper be placed under the carpets. Laying a damp cloth over the carpet and ironing with a hot iron will destroy the insects immediately beneath it.

The Mexican cotton boll weevil, L. O. HOWARD (*U. S. Dept. Agr.*, *Division of Entomology Circ. 6*, *pp. 5*, *figs. 3*).—This is a preliminary report on the life history and best methods of combating *Anthonomus grandis*, which in 1894 appeared in damaging numbers in the cotton fields of southeastern Texas, whither it has spread from its original home in northeastern Mexico. A map is given showing the distribution of the weevil in Texas and Mexico as known at present. The weevil has been confused with the glassy-winged sharpshooter, which is also figured as a means for distinguishing the 2 species.

There are from 2 to 4 or more annual broods of the small grayish beetle feeding in the squares and bolls in both the larval and adult states. A number of larvæ may infest the same boll. The eggs are deposited in the opening buds, and these, as well as the older bolls, either die outright or become stunted or dwarfed and useless for maturing cotton. The life history has not yet been worked out sufficiently to warrant the recommending of remedies as certain, although spraying with arsenites is suggested for the killing of the adult weevils. It is also advised that affected bolls be picked and burned, and that rotation of crops be employed.

The pear tree psylla, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 7, pp. 8, figs. 6*).—Illustrated descriptive notes on the life history, habits, natural enemies, and treatment of *Psylla pyricola*, with special reference to the serious invasion of the pest in 1894 in a large pear orchard in Maryland. The attack was so overwhelming that the honeydew is reported to have covered the leaves and twigs, dripped from the leaves, and run down the trunks, forming a discolored circular spot on the ground for several inches around the bases of the trees. The leaves and fruit were blackened and fell in great numbers and were covered by the smoky fungus *Fumago salicina* growing in the sweetish liquid. Older trees were more seriously attacked than were younger, the varieties Duchess, Bartlett, and Dwarf Lawrence suffering most. It is believed that the psylla was introduced on stock obtained from a New York nursery in 1890, and that the time elapsing before this outbreak was due to some local climatic condition. Five broods were noted, the last two being very scanty in numbers. The lace-winged fly (*Chrysopa oculata*) was seen actively and numerously employed in destroying the psyllas, and its life history is briefly given. The ladybird (*Adalia bipunctata*) also aided in the work of repression. Spraying with strong solutions of kerosene emulsion in early spring, at the time the eggs of the first brood hatch, is recommended, and the use of Bordeaux mixture instead of water to dilute the kerosene emulsion is advised. Winter spraying with kerosene emulsion to kill the hibernating adults is also suggested.

The imported elm leaf beetle, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 8, pp. 4, fig. 1*).—Brief illustrated descriptive notes on the life history, habits, and remedies for *Galerucella luteola*. It is stated that in its southern range—Maryland, Virginia, Delaware, and southern New Jersey—there are 2 annual broods, with occasionally a third, but that farther north there is only 1 well-marked brood. The American elms were but slightly attacked, the European species suffering most. Spraying with arsenicals is recommended as the best treatment, as by this means both larvæ and adult are destroyed. It is urged that the spraying be begun as soon as the insects appear on the trees in the spring.

The elm leaf beetle (*Connecticut State Sta. Bul. 121, pp. 1–6, fig. 1*).—Brief popular notes on this shade tree pest, with details for its destruction. Spraying with a solution of slacked lime and Paris green is recommended, to be applied by powerful force pumps and long hose. If spraying the trees is impracticable, destroying the pupæ by means of pouring kerosene emulsion on the ground under the trees should be done.

Cankerworms, D. W. COQUILLETT (*U. S. Dept. Agr., Division of Entomology Circ. 9, ser. 2, pp. 4, figs. 4*).—A popular description and account of the life history and habits of the spring cankerworm (*Paleacrita vernata*) and fall cankerworm (*Anisopteryx pometaria*), with recommendations for treatment. Banding the trees with some sticky substance to prevent the ascent of the wingless female moths and spraying the infested trees with arsenicals is advised.

The harlequin cabbage bug or calico back, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Circ. 10, ser. 2, pp. 2, fig. 1*).—Popular notes on the appearance, distribution, life history, habits, and treatment of *Murgantia histrionica*. The planting of trap strips of mustard or radishes in cabbage fields on which the bugs will collect, and where they may be destroyed by spraying with kerosene, is recommended as the most efficient remedy. *Trissolcus murgantiæ* is mentioned as a parasite in Louisiana.

The rose chafer, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Circ. 11, pp. 4, fig. 1*).—A short illustrated popular paper on the distribution, life history, and habits, food plants, and remedies for *Macrodactylus subspinosus*. It is believed that spraying with the different insecticides is of no avail, and hand picking or jarring from infested plants on to sheets saturated with kerosene are proposed as the only sure means of reducing the numbers of the pest. Plowing and harrowing infested ground in the spring is advocated for the destruction of the larvæ and pupæ.

The San José scale, W. C. STURGIS and W. E. BRITTON (*Connecticut State Sta. Bul. 121, pp. 6–11, figs. 5*).—Illustrated popular descriptive notes, chiefly compiled, on *Aspidiotus perniciosus*, its life history, habits, ravages, and treatment. The pest has made its appearance near New London, Connecticut, in a peach orchard to which the trees had been imported from New Jersey. The use of a strong solution of whale oil soap has checked the scale, and it is believed it will soon be stamped out. Fumigating with hydrocyanic acid gas and spraying with resin washes or kerosene emulsion and potash washes are also recommended.

Experiments with chinch bug infection in 1894, F. H. SNOW (*Kansas State Bd. Agr. Rpt. 1895, Mar. 31, pp. 156–159*).—A condensed statement of the experiments in combating the chinch bug with Sporotrichum in 1894, the results being favorable and the bugs succumbing to the fungus in great numbers. The attack in 1894 was much less than the preceding year, due, it is believed, to the extensive distribution of

the fungus in that year. Notes are given on one experiment to illustrate the manner in which the Sporotrichum increased among the bugs and destroyed them.

Remedies for flea beetles, C. M. WEED (*New Hampshire Sta. Bul. 29, pp. 7, figs. 6*).—This is a brief account of the life history and habits of the cucumber flea beetle (*Crepidodera cucumeris*) and the striped flea beetle (*Phyllotreta vittata*), their ravages and treatment. The best results were reached by spraying with a solution of slacked lime and Paris green and with Bordeaux mixture. These insecticides may be applied with a force pump set in a bucket or tank, or else by means of a knapsack sprayer. These different forms of apparatus are figured.

Remedies for the horn fly, C. M. WEED (*New Hampshire Sta. Bul. 28, pp. 4, figs. 2*).—This consists of brief illustrated popular descriptive notes on the life history and treatment of this pest. The use of a mixture of crude cotton seed oil or fish oil 3 parts and pine tar 1 part, or of crude cotton seed oil or fish oil 100 parts and carbolic acid 3 parts, applied by means of a brush, sponge, or cloth is recommended. An experiment in spraying the cattle with a mixture of kerosene emulsion and tobacco decoction produced favorable results.

Some new species of Old World Hymenoptera, F. W. KONOW (*Wiener ent. Ztg., 14 (1895), No. 3, pp. 71-78*).—Technical description of 13 new species from the Old World.

The paraplasm of the epidermic cells of insects, J. CHATIN (*Compt. Rend., 120 (1895), No. 23, pp. 1287-1288*).

Report of the entomologist, R. C. SCHIEDT (*Rpt. Pa. State Bd. Agr. 1894, pp. 189-198*).

Beekeeping in Russia (*Abs. in Jour. [British] Bd. Agr., 2 (1895), No. 1, pp. 1-3*).

The most desirable strain of bees, A. F. BROWN (*Florida Farmer and Fruit Grower, 1895, Sept. 28, pp. 615, 616*).

Winter and summer protection for bees, A. GALE (*Agl. Gaz. N. S. Wales, 6 (1895), No. 5 pp 309-315, figs. 3*).

Enemies of the honey bee, G. G. GROFF (*Rpt. Pa. State Bd. Agr. 1894, pp. 215-217*).

Icitwayi in cattle, D. HUTCHEON (*Agl. Jour. Cape Colony, 8 (1895), No. 15, pp. 384, 385*).—The author gives history of introduction in Cape Colony, symptoms, and treatment of Psoroptic mange, caused by *Psoroptes bovis*.

On sheep scab in its relation to sheep husbandry, G. T. BROWN (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 23, pp. 529-541, figs. 2*).—A description of the mite and notes on the diagnosis and treatment of the disease.

Notes on some genera and species of New Zealand Coccidæ, W. M. MASKELL (*Ann. and Mag. Nat. Hist, 16 (1895), No. 92, pp. 129-138*).

The oat cecidomyid (Cecidomyia avenæ), P. MARCHAL (*Compt. Rend., 120 (1895), No. 23, pp. 1283-1285*).

The potato stem-borer (*Meehan's Monthly, 5 (1895), No. 9, pp. 170, 171, figs. 2*).—Illustrated notes are given of *Trichobaris 3 notata* and the injury it does to the potato stem, abstracted from New Jersey Station Bulletin 109 (E. S. R., 7, p. 41).

The mole cricket, V. MAYET (*Prog. Agr. et Vit., 12 (1895), No. 19, pp. 491-495, pl. 1*).—Notes on *Gryllotalpa vulgaris*.

Injurious insects, J. FLETCHER (*Canada Central Exptl. Farm Bul. 23, pp. 18-23, figs. 4*).—A brief popular classification of injurious insects by their mouth parts, with recommendations for treatment of their ravages, directions for preparing and

applying insecticides, and illustrated descriptive notes on the codling moth and plum curculio. The insects are divided into biting, boring, and sucking insects; and in general spraying with Paris green is recommended for the first, washing with carbolic acid emulsion for the second, and spraying with kerosene emulsion for the last.

Noxious insects, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1894, pp. 80–106*).—Illustrated descriptive notes giving the life histories, ravages, and treatment of various injurious insects, among which are the crane fly, Hessian fly, potato grub, cabbage moth, cineraria fly, white scale, and bot fly. The Hessian fly has done considerable damage and threatens more, but it is hoped that by cultural methods and the use of natural enemies the attack will be abated.

Insects affecting fruit and forest trees, their life history and method of combating them, G. HENSCHEL (*Die schadlichen Forst- und Obstbauminsecten, ihre Lebensweise und Bekämpfung. Berlin: Parey, 1895, pp. 758, figs. 187*).—A practical handbook for foresters and gardeners.

Report on observations made in 1894 at the entomological station of Paris, BROCCHI (*Bul. Min. Agr. France, 14 (1895), No. 6, pp. 684–693, pl. 1*).

Destruction of the scale insects of the vine and fruit trees, GILLETTE-ARIMONDY (*Prog. Agr. et Vit., 12 (1895), No. 27, pp. 16–18*).

On the use of cloths saturated with kerosene for combating plant enemies, R. OTTO (*Ztschr. Pflanzenkrank., 5 (1895), No. 4, pp. 200–203*).

Means of destroying the codling moth, S. MOTTET (*Jour. Agr. Prat., 59 (1895), No. 39, pp. 443, 444, fig. 1*).

The means of combating insects in the last ten years, SCHELLENBERG (*Fühling's landw. Ztg., 44 (1895), Nos. 15, pp. 465–472; 16, pp. 505–515*).—A popular article.

Nematode injuries and potash fertilizing, HELLRIEGEL (*Ztschr. Rübenzind., 45 (1895), p. 604; abs. in Chem. Ztg., 19 (1895), No. 68, Repert., p. 244*).

Preliminary note on a contagious insect disease, S. A. FORBES (*Science, n. ser., 2 (1895), No. 38, pp. 375, 376*).—A preliminary report is given of a bacterial disease discovered in the squash bug and which is very easily spread to the chinch bug, being more infectious than the *Sporotrichum*.

FOODS—ANIMAL PRODUCTION.

Digestion experiments with sheep, J. B. LINDSEY, R. H. SMITH, and E. B. HOLLAND (*Massachusetts State Sta. Rpt. 1894, pp. 146–174*).—The results are given of digestion experiments with 4 sheep, 2 two years old and 2 four years old, on the following feeding stuffs: Hay of mixed grasses—principally Herd's grass, redtop, Kentucky blue grass, meadow fescue, sweet-scented vernal grass, with a fair sprinkling of clover; hay of vetch and oats, cut when in late blossom; new process linseed meal; Buffalo gluten feed; Peoria gluten feed; Chicago maize feed; King gluten meal (containing 19 per cent of fat); Atlas meal (a dried distillery refuse); peanut meal (peanut shells finely ground with a small admixture of the nut); soja-bean meal; rye meal, and winter-wheat bran. The hays were fed alone and the other materials were fed in connection with hay.

The analyses of the feeding stuffs are given, and the temperature of the stable, water drunk, weight of sheep at beginning and end of period, and other data relative to the experiments are fully tabulated.

A summary of the digestion coëfficients obtained is given in the following table:

Summary of digestion experiments with sheep.

	Dry matter.	Crude cellulose.	Crude fat.	Crude protein.	Nitrogen-free extract.
English hay (a):					
Sheep 1	57.93	60.90	49.11	57.45	58.65
Sheep 2	58.49	61.24	51.82	57.11	58.52
Sheep 3	58.17	62.27	43.88	55.88	59.07
Sheep 4	61.57	65.32	53.73	62.49	61.07
Average	59.04	62.44	49.63	58.23	59.33
English hay (b):					
Sheep 1	53.89	55.54	46.67	57.16	55.76
Sheep 2[1]	54.33	57.25	48.65	52.23	56.76
English hay (c):					
Sheep 3	54.72	57.30	45.28	57.32	56.12
Sheep 4	56.20	59.04	48.50	59.82	58.19
Average for b and c	54.94	57.29	46.82	58.10	56.69
Hay of vetch and oats:					
Sheep 3	58.07	65.16	16.75	60.92	54.42
Sheep 4	58.14	66.88	20.40	58.48	53.88
Average	58.10	66.02	18.57	59.70	54.15
New process linseed meal:					
Sheep 1	77.24	99.47	102.20	83.12	86.60
Buffalo gluten feed:					
Sheep 3	89.35	94.69	92.74	88.69	88.93
Sheep 4	91.11	104.56	95.61	88.88	89.76
Average	90.23	99.60	94.17	88.78	89.34
Peoria gluten feed:					
Sheep 1	84.07	58.69	81.63	81.42	89.77
Sheep 4	87.19	97.44	75.58	84.53	89.99
Average	85.63	78.06	78.60	82.97	89.88
Chicago maize feed:					
Sheep 3	88.09	86.45	91.00	84.92	89.52
Sheep 4	86.19	78.48	92.03	86.00	86.22
Average	87.14	82.46	91.51	85.46	87.87
Chicago gluten meal:					
Sheep 1	91.74	39.04	96.05	88.52	96.17
Sheep 2	93.70	4.16	98.22	92.49	97.25
Average	92.72	21.60	97.13	90.50	96.71
King gluten meal:					
Sheep 1	86.98	39.47	92.12	91.52	85.57
Sheep 2	83.96	....	97.63	92.34	82.44
Average	85.47	....	94.87	91.93	84.00
Atlas meal:					
Sheep 3	79.53	94.88	92.43	73.04	84.00
Sheep 4	79.75	116.50	90.06	72.56	84.91
Average	79.64	105.70	91.24	72.80	84.45
Peanut feed:					
Sheep 3	31.93	9.88	90.01	71.12	57.52
Sheep 4	32.26	13.49	89.36	70.00	40.59
Average	32.09	11.68	89.68	70.56	49.05
Soja-bean meal:					
Sheep 3	78.15	48.27	81.28	89.97	75.57
Sheep 4	85.58	94.09	90.09	92.20	77.02
Average	81.86	71.18	85.68	91.08	76.29
Rye meal:					
Sheep 1	89.51	....	65.37	83.46	94.47
Sheep 2	85.18	....	62.98	85.31	89.34
Average	87.34	....	64.17	84.38	91.90
Winter-wheat bran:					
Sheep 1	60.68	5.37	53.02	77.69	72.05
Sheep 2	63.83	23.29	80.39	78.65	71.76
Average	62.25	14.33	66.70	78.17	71.90

[1] Not included in average; period lasted but 3 days.

"The hays prove to be about as digestible as those tested a year ago, and correspond in digestibility very closely to the figures given by Wolff. . . .

"Hays *b* and *c* were from the same lot, but the tests were made at different times and 2 separate samples were taken. . . .

"The vetch and oats hay appears, with the exception of the fat, to be about as digestible as good English hay.

"[With new process linseed meal] this test corresponds fairly with those made a year ago. The animal appeared to have very thoroughly assimilated the fat of the meal.

"This sample [of Buffalo gluten feed] gives distinctly higher digestion percentages than the one tested a year ago. The reason for this can not be given. The parallel tests in each case agree closely. Other samples will be procured and further tests made.

"[Peoria gluten feed and Chicago maize feed] correspond very closely one with the other in the amounts of digestible matter they contain The Peoria feed was inferior in composition to the maize feed. . . .

"The Chicago meal shows an exceptional degree of digestibility, 93 per cent of the entire meal having been assimilated. The King gluten meal was also quite digestible, 85 per cent of the total dry matter being assimilated.

"The Atlas meal has 80 per cent of digestible matter. The protein is about 73 per cent digestible. It is somewhat inferior to the gluten meals in digestibility, although, with the exception of the increased percentage of cellulose present, it resembles them in composition. The cellulose appears in this test to have been all digested. This meal is a valuable addition to our feed-stuff supply, if it can be bought at a reasonable price. Additional digestion tests will be made.

"[Peanut feed] is unquestionably of inferior feeding value. Its dry matter was but 32 per cent digestible, and it contained 51 per cent of cellulose, of which but 12 per cent was digested. The fat and protein were quite well assimilated, but the percentages contained—especially that of the protein—were comparatively small. The extract matter was only 49 per cent digestible.

"The test of [soja-bean] meal was not entirely satisfactory, the variations in the percentages of cellulose and fat digestible in case of the 2 sheep being too large. Wolff gives the results of but 2 single trials with this meal, which correspond fairly with the figures found in our trial.

"Wolff gives no direct digestion coëfficients for rye. Our results make it appear practically as digestible as the corn meal, the protein even more so.

"The digestibility of [winter-wheat] bran is practically the same as the spring bran reported last year. As these 2 brans appear to have also the same percentage composition they should be worth the same price per ton. Different seasons might exert some influence on composition and digestibility."

Concerning the digestibility of the pentosans, J. B. LINDSEY and E. B. HOLLAND (*Massachusetts State Sta. Rpt. 1891, pp. 175-188*).—In the introduction the authors give a concise résumé of studies on the pentosans, and describes in detail the method used in their quantitative determination, illustrating the apparatus employed. In connection with digestion experiments with sheep, some of which are reported elsewhere (p. 316), determinations were made of the pentosans in the rations and in the excreta and feces. From these data the percentage of the pentosans in each of the various feeding stuffs which was digested by the sheep is calculated. The results are summarized below:

Proportion of the pentosans in various feeding stuffs digested by sheep.

	Per cent		Per cent.
Hay of mixed grasses (*a*):		Old process linseed meal:	
Sheep 2	63.00	Sheep 2	86.40
Sheep 3	64.80	Sheep 3	89.40
Sheep 4	62.10	Sheep 4	80.10
Average	63.30	Average	85.30
Buffalo gluten feed:		Corncobs:	
Sheep 2	75.10	Sheep 1	63.50
Sheep 4	83.10	Sheep 2	64.10
Average	79.10	Average	63.80
Hay of mixed grasses (*b*):		Dried brewers' grains:	
Sheep 1	62.70	Sheep 1	56.80
Sheep 2	60.10	Sheep 2	56.10
Sheep 3	62.50	Average	56.40
Sheep 4	64.30	Spring wheat bran:	
Average	62.40	Sheep 2	61.70
New process linseed meal:		Sheep 3	62.50
Sheep 2	84.30	Average	62.10
Sheep 3	93.90	Winter wheat bran:	
Average	89.10	Sheep 4	63.90

The above data are compared with the digestibility of the other constituents in the following table:

Comparative digestibility of pentosans and other food constituents.

Kind of food	Dry matter.	Crude cellulose.	Crude fat.	Crude protein.	Extract matter.	Pentosans.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Hay of mixed grasses (*a*)	61	64	51	63	63	63
Hay of mixed grasses (*b*)	56	57	47	57	58	62
Buffalo gluten feed	78	43	81	85	81	79
New process linseed meal	81	61	91	87	86	89
Old process linseed meal	79	57	89	89	78	85
Corncobs	59	65	50	17	60	64
Dried brewers' grains	62	53	91	79	59	56
Spring wheat bran	63	24	76	80	70	62
Winter wheat bran	60	56	61	79	70	64

"The above figures show that the pentosans in 6 out of 9 cases are practically as digestible as any of the other groups of fodder substances.

"In both samples of hay the pentosans are fully as digestible as either the cellulose or protein. In case of the dried brewers' grains and the 2 brans the fat and protein are noticeably more digestible than the pentosans.

"With the more concentrated foods it will be observed that the pentosans are as digestible as either the fat, protein, or extract matter. The results make clear that association has a great deal to do with digestibility. In the hays, corncobs, and brewers' grains, where the woody substance (lignin) is present to a considerable extent, the digestibility of the pentosans is noticeably less than when the incrusting substance is absent. Whether or not the pentosans are chemically united to the incrusting substance is not known, but it is not at all improbable. It is certainly clear that the incrusting substances perceptibly interfere with the digestibility of the xylan or araban. This has also been proved to be the case with cellulose, first indirectly by Henneberg and Stohmann[1] and later directly by F. Lehmann, who found that when the fiber was freed from all incrusting substances the cellulose was practically all digestible.

"Stone has already shown, in case of hays, bran, and such fodders, that the pentosans have an average digestibility of 60 per cent, and our results with similar fodders simply confirm his investigations. With the more concentrated feeds, where little incrusting substance is present, the pentosans are as digestible as any other of the fodder groups. One might assume that if the pentosans were isolated and fed to animals they would be fully as digestible as starch or pure cellulose.

[1] Futterung der Wiederkauer, 1860.

"While from 60 to 90 per cent of the pentosans in the present experiment have been removed from the digestive tract in the process of digestion, it has certainly not been demonstrated that they have been assimilated and have a food value equal to that of starch and similar substances. In case of human beings Ebstein has already proved to the contrary. We hope to be able to throw additional light upon this point in the near future."

Comparative value of different coarse feeds, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 32–41*).—The object of this experiment was to compare common hay with hay of vetch and oats and with soja bean hay and barley straw for milk production. Six cows in different stages of the milking period were used. They were all fed the same rations. The grain ration, 3 lbs. each of wheat bran, Buffalo gluten feed, and new process linseed meal, remained constant. The coarse fodder was different in each of the 3 periods. Composite samples of milk were taken for 3 days in each week. The details of the experiment, including analyses of the milk and of the feeding stuffs, are tabulated. The average results follow:

Comparison of different coarse fodders for cows.

Period.	Date	Coarse fodder	Nutritive ratio of ration	Total cost of ration per day	Average daily yield of milk	Average cost per quart of milk.[1]
				Cents.	*Quarts.*	*Cents.*
1	Oct 5 to 16	17.63 lbs. common hay . .	1:4.40	22.97	10.22	2.25
2	Oct 25 to Nov 27 ..	16.52 lbs. hay of vetch and oats	1:4.20	22.14	9.43	2.35
3	Dec 9 to Jan 2 ...	10.81 lbs. soja bean hay, 4.56 lbs. barley straw	1:4.13	20.14	8.73	2.31

[1] Different kinds of hay at $15 and barley straw at $10 per ton.

"The cost of feed per quart of milk is about the same in all 3 periods, a very slight difference in favor of the hay period being observed, which would probably be counterbalanced when the longer vetch and oats period and the natural decline in yield are considered. The vetch and oats hay compared, then, quite well with the first cut hay of upland meadows.

"While the soja-bean hay and barley straw compared very favorably with the other coarse fodders, it is hardly to be commended, because of the tendency of the bean leaves of the soja-bean plant, like all leguminous crops, to dry up and fall off in the process of curing. The soja bean can be much better preserved in the silo mixed with corn fodder. . . .

"The composition of the milk was apparently not affected by the different coarse fodders."

Hay substitutes, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 88–91*).—This is a discussion of the value of hay from vetch and oats and from peas and oats as substitutes for common hay, the results being cited of the above feeding experiment with cows, and from the Annual Report of the station for 1893 (E. S. R., 6, p. 326). The culture of vetch and oats, seed per acre, and composition and digestibility as compared with hay, are given.

"Vetch and oats furnish very nearly as much digestible matter in a ton as an extra quality of hay. The digestible protein in the vetch and oats is fully 1 per cent higher than in the hay. . . .

"Vetch and oats have the advantage over peas and oats in that the vetch stands up much better, and can be easily cut with a mowing machine. To secure the best results the crops should be cut when in early to middle bloom. If cut when in late bloom the oats will have developed a considerable amount of woody fiber, rendering them less palatable and digestible."

Feeding calves for veal, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 125–145*).

Synopsis.—A trial of feeding 7 calves on skim milk made richer in fat by adding oleomargarine, cotton-seed, and corn oils. The calves were in better condition after 7 weeks' feeding than those grown on skim milk alone, but were not as fat as sucking calves. The financial result was not satisfactory.

The results are cited of experiments reported in the Annual Report of the station for 1893 (E. S. R., 6, p. 322). These calves, although they made good gains, "put on very little fat either when fed on skim milk alone or when fed on skim milk and grain. They were not able to digest the necessary amount of corn meal, Buffalo gluten feed, wheat flour, or middlings when fed in connection with the nitrogenous milk to promote the formation of fat."

The object of the present experiment was to try the effect of replacing the fat of whole milk by some cheaper fat or oil, producing a mixture resembling whole milk in composition. The plan was to make an emulsion of fat or oil with the skim milk. A cheap grade of oleomargarine, jacket tallow, cotton seed oil, and corn oil were used. The fat was heated and then placed with the skim milk in a can and agitated with a dasher consisting of a perforated tin disk attached to a rod. "By this method the oil was quite well mixed with the milk, and the resulting solution had a very pleasant smell, closely resembling that of new milk." Where 1 oz. of oleomargarine was used per quart of skim milk the mixture contained 86.6 per cent of water, 13.4 per cent of solids, and 3.78 per cent of fat.

Seven calves, ranging from 2 to 10 days old when the trial commenced, were used. There were 2 grade Jerseys, 2 grade Durhams, 2 Holsteins, and 1 grade Ayrshire. All were fed whole milk for the first 4 or 5 days, and then gradually changed to the mixtures. Five calves received skim milk mixed with oleomargarine at the rate of 1 oz. per quart of skim milk. One received skim milk with ½ oz. each of oleomargarine and cotton-seed and corn oils per quart of skim milk, and the other skim milk with ½ oz. of oleomargarine and 2 oz. of brown sugar per quart of skim milk. Jacket tallow was tried in the latter case, but proved unsatisfactory, as it crystallized too rapidly. No additional food was given.

"Scarcely any of the calves appeared to be able to take more than 1 oz. of 'oleo' to each quart of skim milk without disturbing their digestion. When 1½ oz. per quart was fed indigestion nearly always resulted, and the manure voided contained an excessive amount of fat, fatty acids, and similar substances. During the last few weeks of the calf's life 1½ oz. were fed for each quart of the skim milk."

The detailed and summarized results are given for each calf, together with analyses of the whole milk and skim milk with reference to both food and fertilizing ingredients.

The feeding lasted on an average about 7 weeks. The average gain in live weight per day for the 5 calves receiving skim milk and oleomargarine was 1.68, 1.65, 1.45, 1.37, and 1.30 lbs., respectively; for the calf on skim milk, oleomargarine, and cotton seed and corn oils, 1.37 lbs.; and for the one on skim milk, oleomargarine, and brown sugar, 2.04 lbs.

"The financial results of the experiment are not satisfactory. The average return for the skim milk in case of the 7 calves was but 0.28 ct. per qt. Last year, when skim milk alone was fed, a return of from 0.63 to 0.73 ct. per quart was secured. Although the condition of these calves was superior to that of those grown on skim milk alone, our local butcher refused to give much if any more, simply because they were not 'suckers.' Whole milk veal being worth 6 cts., live weight, these calves were certainly worth 5 cts., while for nearly all of them but from 4 to 4½ cts. could be obtained. If 5 cts. per pound live weight had been obtained the financial showing would have been better, but even then not satisfactory. The condition of the calves fed on artificial milk was, as above mentioned, much more satisfactory than that of those fed on the skim milk. They were not, however, equal in fatness to sucking calves.

"It is intended to note the effect of this mixture on other calves. It must be admitted that considerable labor is required to feed calves as described, and when pork brings from 6½ to 7 cts. per pound dressed weight it will undoubtedly be more profitable to feed the skim milk to pigs. The average farmer would not find it profitable to attempt to fatten veal calves by this method.

"If the mixture of skim milk, 'oleo,' and brown sugar or skim milk and brown sugar gives approximately as good results with the average calf as it did in case of calf 7 of the present experiment, fatting veal by this process might prove profitable to a limited number when circumstances were favorable."

Fifth feeding experiment with steers, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1891, pp. 101–111*).—Three grade Durham yearling steers, weighing about 600 lbs. each, were used in an experiment covering 6 periods, in each of which a different ration was fed. The duration of the periods was as follows:

Period 1, May 16 to June 8	Period 4, November 28 to January 2
Period 2, June 21 to July 4	Period 5, January 27 to February 11
Period 3, November 7 to 20	Period 6, March 1 to 27

The rations fed in each period and a summary of results are given in the following table:

Summary of results of feeding steers.

Period	Average daily rations	Average cost of ration: Total	Average cost of ration: Net[1]	Average gain per day	Average cost of feed per pound of gain: Total	Average cost of feed per pound of gain: Net[1]
		Cents.	*Cents.*	*Pounds.*	*Cents.*	*Cents.*
1	3 lbs. Buffalo gluten feed, 2 lbs. linseed meal,[2] 39.38 lbs. soja bean and corn silage	10.86	3.87	1.50	7.24	2.56
2	Grain same as in period 1 and 14 lbs. rowen hay	15.95	6.6	.88	18.01	7.53
3	3 lbs. wheat bran, 3 lbs. linseed meal,[2] and 15.3[illegible] lbs. corn stover	10.[illegible]	.39	.93	11.16	.43
4	Grain same as in period 3 and 12.07 lbs. corn stover and 12.07 lbs. roots[3]	12.[illegible]	2.30	.95	13.42	2.42
5	4 lbs. Buffalo gluten feed, 4 lbs. oat feed, 4 lbs. corn stover, 28.91 lbs. corn silage, and 15 lbs. turnips	15.49	4.88	1.87	8.29	2.61
6	4 lbs. cotton seed meal, 4 lbs. corn and cob meal, 4 lbs. corn stover, and 42.39 lbs. corn silage	15.30	5.20	.81	18.88	6.42

[1] Assuming 90 per cent of fertilizing ingredients to be recovered in the manure.
[2] New process.
[3] Potatoes or mangel wurzels.

The analyses of the feeding stuffs used with reference to both food and fertilizing ingredients are tabulated. The steers were purchased March 28, 1893, at 3.69 cts. per pound, and were sold April 4, 1894, for 3.85 cts. per pound live weight. The financial result is given for each steer and summarized for the three. At the time of selling, the steers averaged about 1,100 lbs. each. The total gain made by the 3 steers was 1,665 lbs. The original cost of the steers and the total cost of the food eaten amounted to $210.68; the amount received for the steers was $126.21. The calculated value of the manure, assuming 90 per cent to be recovered, is given as $100.08, which a little more than covers the deficit. The total cost of feed per pound of gain in live weight was 9.08 cts. and the net cost 3.04 cts.

"The total cost of the 3,289 lbs. of live beef actually sold was 6.41 cts. per pound, and the net cost, found by deducting the manure reckoned at a maximum value, is 3.36 cts. The steers were sold at 3.85 cts. per pound live weight. The animals gained 1.48 lbs live weight daily during the entire experiment. We hardly think it possible to secure better results with the average grade steer. The results, however, make an unfavorable financial showing"

The results of soiling the steers during the summer are compared with those obtained in previous years with steers kept at pasture. A fuller discussion of this subject is given in the following article.

General summary of feeding experiments with growing steers, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 117–121*). This is a summary of experiments carried on at the station from 1890 to 1894 (E. S. R., 3, p. 162; 4, p. 478; 5, p. 198; 6, p. 318; and 7, p. 322). In all 10 steers were used, 7 grade Shorthorns and 3 grade Durhams, all yearlings when the trials commenced. The data for these steers are summarized, showing the digestible matter eaten per pound of gain on different rations for yearlings and 2 year-olds, cost of the rations, and cost of the food per pound of gain.

"The chief coarse fodders fed were corn stover, corn fodder, corn silage, and hay and roots. In case of both yearlings and 2-year-olds the greatest daily gain was made when the coarse fodder consisted of corn silage. Corn fodder and hay and roots also made a very fair showing.

"Corn stover, when fed as a part of the daily coarse-fodder ration, makes a valuable food, but when given as a coarse feed exclusively the animals will not consume a quantity sufficient to produce the requisite gain. It has not the sweet taste of the hay, nor the sour, appetizing taste of the silage.

"On comparing the daily gains with the amount of digestible matter consumed daily, it must be admitted that for an equal amount of digestible matter the corn silage rather exceeds all other coarse fodders. . . .

"The relative cost of feeds required to produce 1 lb. of live weight was higher with 2-year-olds than with yearlings. This is in accordance with general teaching.

"Again, live weight was produced at the lowest cost both with yearlings and 2-year-olds when corn silage was the principal coarse fodder of the daily ration. The corn-fodder ration is the next higher in cost, and then follow the corn stover and finally, as the highest, the hay ration. When the net cost of feed per pound of live weight gained is considered, the corn stover period compares very favorably with the silage and corn-fodder periods.

"In the grain addition to the coarse fodders the point has been to so combine them as to get from 2 to 2.5 lbs. of digestible protein in the daily ration. . . .

"[The financial] results are not at all encouraging. The first cost of the steers plus the feed consumed amounts to more than the returns from the beef plus the value of manure reckoned at a maximum price.

"The cost of feed to produce a pound of live weight has been 10.58 cts., while the total cost to us of a pound of live weight (obtained by adding to the original cost of the steers the cost of the feed consumed, and dividing by the pounds of live weight sold) is 6.89 cts. The net cost to us of a pound of live beef reckoned in the same way is 4.34 cts. Only by reckoning the manure at a maximum value have we been able to produce live beef at 4.34 cts. per pound, the cost of attendance not being included. It must be remembered, however, that our coarse fodders and grains were charged at market rates. . . .

"[Notwithstanding this] the writer believes that by beginning with young calves from animals that have extra reputation for rapid growth, and following a judicious system of feeding, it will yet be possible to produce beef economically in Massachusetts."

A comparison is given between steers pastured in the summers of 1890 and 1891 and steers soiled during the summers of 1892 and 1893.

"The animals soiled made fully 2¼ times as large a daily gain as did the pastured lots. This is probably due to an abundance of food on the part of the soiled steers. The pastures were what were termed 'good' by the average farmer.

"The total cost of feed to produce a pound of live weight is about the same in each case. In case of the soiled animals, however, the manure is left upon the farm. . . .

"Other things being equal, steers can at least be as economically grown by soiling as by pasturing."

Comparative tests of different breeds of beef cattle, P. SCHWEITZER (*Missouri Sta. Bul. 21., pp. 89, pls. 8*).—An experiment in feeding 5 Shorthorn, 3 Hereford, 4 American Angus, 4 grade, and 4 native or "scrub" steers for beef. At the beginning of the experiment the animals ranged from 2 to 10 months old; 15 were 8 months or over. The trial with most of the steers commenced in January, 1889. Half of them were killed early in November, 1890, and the remainder during February, 1891. The feed was alike for all the steers, and for the most part was given *ad libitum*. It consisted of corn meal and wheat bran with or without linseed cake and cotton seed meal; with hay, silage, roots, and green crops for coarse fodder. The first season the steers were pastured from May to December and the second season from June to about the 1st of October.

They were taken to the fat stock show in Chicago in November, 1889. Ten head were sold there and the remaining ten, 2 from each lot, were returned to the station for further feeding. They were slaughtered between February 2 and March 3, 1891.

"The total time of the experiment, nearly 2 years, is divided into 5 periods. This is done for two purposes; the first, to separate and perhaps eliminate the third or middle period entirely, as the animals, during the 120 days which it lasted [January, February, March, and April, 1890], were kept at a maintenance ration and gained practically no weight at all; and the second, to separate the periods of exclusively dry feeding from those in which pasturing, with a feeding of green grass or silage as a start, supplemented dry feed wholly or in part."

The detailed data for the food eaten, live weight, rate of increase, and amount of food eaten per pound of gain are tabulated for each animal. In addition, plates are given showing the dressed carcasses and sections of the same for each of the 10 animals slaughtered at the station. The weight of different cuts of the carcass, size of the femur and tibia bones and the weight required to crush them, and the strain required to break the muscle *gastrocnemius externus* are given.

The food eaten is calculated for 80 per cent of water in the case of silage, roots, and grass, and 10 to 12 per cent in the case of other feeding stuffs. This basis is used in calculating the food eaten per pound of gain. A summary of the daily gain in weight and the food eaten per pound of gain by periods, excluding the third period, during which a maintenance ration was fed, as mentioned above, is given in the following table.

Food eaten per pound of gain in weight, and average daily gain, by periods

	Food eaten per pound of increase				Average gain in weight per day			
	First period 108 days	Second period 245 days	Fourth period [illegible] days	Fifth period	First period	Second period	Fourth period	Fifth period
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Shorthorn								
Sanborn	9.0	10.0	10.3	7.1	1.44	1.1	2.29	3.57
Francis	8.[illegible]	11.3	11.8	7.[illegible]	1.78	1.18	1.91	2.91
Allan	9.5	10.[illegible]	11.4	(3.[illegible])	1.51	1.21	2.08	(5.14)
Parker	11.[illegible]	11.3	11.0	(3.7)	1.25	1.16	2.22	(4.93)
Wilson	12.3	[illegible]	(1[illegible])	(4.0)	1.37	1.01	1.43	(4.29)
Average	10.1	11.3	1[illegible].0	7.3	1.47	1.17	2.01	4.17
Hereford								
Zeno	10.1	11.[illegible]	1[illegible]	7.8	1.45	1.16	1.76	2.94
Curley	12.0	9.3	1[illegible].3	11.[illegible]	1.37	1.40	2.31	1.84
Dandy	7.8	10.2	12.5	4.3	1.02	1.28	1.94	(4.85)
Average	9.[illegible]	10.3	12.1	8.0	1.48	1.28	2.00	3.21
Angus								
Ben	7.0	9.5	11.0	9.0	2.0[illegible]	1.30	2.27	2.61
Bonnie	[illegible].4	8.7	11.9	[illegible].1	1.78	1.46	2.10	2.29
Elbert	7.[illegible]	11.2	12.6	(4.4)	1.1	1.13	1.32	(4.29)
Jean	[illegible].0	7.9	12.5	(3.8)	1.92	1.60	1.93	(4.64)
Average	7.8	[illegible].3	12.0	[illegible].6	1.88	1.37	2.0[illegible]	3.46
Grade								
Joe	1[illegible].7	11.7	11.8	7.9	1.0	1.12	2.07	2.96
Nancy	13.1	8.[illegible]	12.[illegible]	11.1	1.10	1.48	1.87	1.88
Newman	8.6	9.[illegible]	11.3	7.0	1.7[illegible]	1.[illegible]	2.13	3.00
Wilkes	11.1	7.4	11.7	(2.7)	1.31	1.73	2.0[illegible]	6.00
Average	11.6	[illegible].5	11.[illegible]	7.2	1.2[illegible]	1.41	2.03	3.96
Scrub								
Jack	7.3	9.7	13.[illegible]	[illegible]	1.71	1.30	1.5[illegible]	3.54
Slocum	5.4	12.1	11.7	10.5	1.63	1.04	1.64	1.74
Quisenberry	9.4	[illegible].0	13.7	2.3	0.96	1.40	1.45	6.22
Young	(18.[illegible])	7.5	12.3	2.6	(0.49)	1.[illegible]	1.63	3.57
Average	9.6	9.6	12.8	5.4	1.21	1.33	1.57	3.77

The summary of the above data, by breeds, is as follows:

Food required to make 1 lb. of increase, and daily increase, for the whole time of experiment

Breed	Food to make 1 lb. of increase	Breed	Daily increase
	Pounds		*Pounds*
Angus	9.3	Angus	1.79
Grade	9.6	Grade	1.69
Scrub	9.6	Hereford	1.67
Shorthorn	10.3	Shorthorn	1.66
Hereford	10.4	Scrub	1.51

A comparison is made between the average gain per day in the second and fourth periods, when the animals were pastured, and the first and fifth periods, when on dry feed. The result of this comparison is as follows:

Average daily gain of steers on pasturage and on dry feed.

Breed	Pasturage	Breed.	Dry feed
	Pounds		*Pounds*
Grade	1.72	Shorthorn	2.82
Angus	1.71	Angus	2.67
Hereford	1.64	Grade	2.62
Shorthorn	1.58	Hereford	2.34
Scrub	1.45	Scrub	2.49

The cost of food is based on the following valuation per pound of the different feeding stuffs: Corn meal and wheat bran, ⅞ ct.; linseed and cotton-seed meal, 1 ct.; corn-and-cob meal, ½ ct.; cut oats and timothy hay, $\frac{3}{10}$ ct.; roots, ¼ ct.; silage and cut grass, $\frac{1}{10}$ ct., and pasture, $1 per month per head. Excluding the third period, where the maintenance ration was fed, the average cost of food per pound of gain in weight in the case of the different breeds was as follows:

Cost of food per pound of gain in weight.

	Cents
Scrub	6.01
Angus	6.12
Grade	6.61
Shorthorn	6.79
Hereford	7.17

While the scrubs on the average produced a pound of gain at the lowest cost, it is explained that this does not indicate a superiority of this over all other breeds, as the scrubs at 3 years old weighed from 130 to 280 lbs. less than the animals of other breeds, which were younger.

"Comparing the scrub with the Angus and Shorthorn, we find the two latter weighing respectively 130 and 260 lbs. more, while being 110 and 55 days younger than the former. This means that to produce 130 lbs. additional live weight of Angus or 260 lbs. of Shorthorn costs respectively 13 cts., or $2.08 more than to raise the same weight of scrub, with a gain in time, however, of nearly 5 months for the former and 2 months for the latter, which in labor saved and in reduced risk of accident amply makes up for it."

The "specific daily increase," obtained by dividing the live weight by the age in days, is believed by the author to give "the proper expression of the value of a breed." This is calculated to be as follows:

Specific daily increase of breeds.

	Pounds.
Angus	1.606
Shorthorn	1.597
Grade	1.536
Hereford	1.507
Scrub	1.250

"I would affirm, then, that in point of early maturity, in power of attaining heavy weight, and in certainty of commanding a market at profitable prices, the breeds stand in the following order: Angus, Shorthorn, grade, Hereford, and scrub."

The cost per pound of butcher's cuts and of lean meat in the same, making allowance for the fat, is given as follows:

Cost of butcher's cuts and of lean meat in cuts

	Cost of animal	Cost per pound of— Butcher's cuts	Lean meat in cuts
Shorthorn		*Cents*	*Cents*
Sanborn	$116.25	10.7	16.5
Francis	114.14	11.3	17.3
Average	115.20	11.0	16.9
Hereford			
Zeno	110.49	11.4	19.7
Curley	116.87	11.2	20.5
Average	113.68	11.3	20.1
Angus			
Bear	10[illegible].67	10.0	16.6
Bonnie	92.11	10.0	15.5
Average	97.89	10.0	16.0
Grade			
Joe	108.43	11.1	16.4
Nancy	109.03	10.5	16.3
Average	108.73	10.8	16.4
Scrub			
Jack	89.01	10.5	15.3
Slocum	76.81	10.1	16.5
Average	82.91	10.[illegible]	1[illegible].9

No conclusions are drawn from the data as to the size and strength of the bones and muscle tested.

An inquiry into the composition of the flesh of cattle, P. SCHWEITZER (*Missouri Sta. Bul. 25, pp. 105, fig. 1*).—This was a part of the investigation on different breeds of cattle for beef production, reported above. Samples of the different cuts of the carcass, the several internal organs, and the blood were taken at the time the 2 steers of each lot were slaughtered. These were analyzed, the methods employed being described in the bulletin. Most of the data thus secured for the 10 steers is fully tabulated, and a diagram is given showing the manner in which the carcasses were cut up. The weights of the different cuts and parts are also given; and the analytical data are summarized to bring out different points. The data are discussed quite fully, frequently in a speculative way. The omission of certain data at time of slaughtering and sampling quite frequently makes it necessary for the author to assume certain facts. In some cases this omission prevents the drawing of inferences which would be interesting. The manner of cutting up the carcasses was such that the different cuts can not be discussed intelligently without reference to the chart showing their location. This makes the presentation of the matter in an abstract unsatisfactory. Only some of the more general data can be given.

The proportion of fat in the cuts of meat and in the organs of the different steers is shown in the following table, taken from the bulletin:

Proportion of fat in cuts and organs of different kinds of steers.

	Shorthorn	Hereford	Angus	Grade	Scrub.
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Cuts					
Steer 1	34 94	42 06	39 71	32 42	34 47
Steer 2	34 51	45 68	35 75	35 87	38 94
Average	34 72	43 87	37 73	34 14	36 70
Increase over lowest	58	9 73	3 59		2 56
Organs					
Steer 1	6 41	6 35	6 36	6 57	6 03
Steer 2	5 73	7 07	6 38	8 14	6 88
Average	6 07	6 71	6 37	7 85	6 45

"Making allowance for individual differences the conclusion seems justified that in the quantity of fat produced in the feeding of cattle breed exerts an influence, and, looking at the question from a commercial standpoint, that Shorthorns and their grades are superior and more profitable than other cattle."

The author discusses the relation between the fat and the water in the cuts and organs, and arranges the data according to the water content of the different cuts. The order is different from that where the arrangement is according to fat content, "and proves, if anything, that water and fat have no functional relation to each other."

The following shows the arrangement of the breeds according to the water content of cuts and organs.

Animals arranged according to water content of cuts and organs

By cuts	Water	By organs	Water	By both	Water
	Per cent		*Per cent*		*Per cent*
Scrub	76 23	Grade	86 62	Scrub	81 47
Hereford	76 75	Scrub	86 66	Grade	81 71
Grade	76 80	Shorthorn	87 35	Hereford	81 86
Shorthorn	77 00	Angus	87 39	Shorthorn	82 17
Angus	77 10	Hereford	(?) 86 98	Angus	82 24

"The differences between the water contents of the groups are small, but, if resting on race traits, of influence upon the quality of the flesh as an article of food. Barring individual peculiarities, it places in point of palatability, or rather juiciness of flesh, Angus and Shorthorns ahead of grades and Herefords, and these again ahead of scrubs, which experience, as judged by public demand, seems to justify."

The author considers the relation of the blood, heart, and lungs to each other and to the vital qualities of the animal, and concludes that these bear a proportionate relationship to each other and are mutually dependent.

"A great heart means great lungs and much blood, and *vice versa;* conceding a certain power of compensation, the three together may be taken as a fair indication of an animal's vital power, not alone in reference to work, but also as concerns bulk and ability to attain it. It would likewise, then, bear a distinct relationship to live weight."

The relation of the combined weight of the heart, blood, and lungs to the live weight and to the "body weight," *i. e.*, the weight of the body, less the contents of stomach and intestines, is brought out for each breed in the following table:

Relation of heart, blood, and lungs to live weight and body weight.

Breed.	Body weight.	Breed.	Live weight.
	Per cent.		*Per cent.*
Shorthorn	4.81 4.81	Shorthorn	4.45 4.89
Angus	4.77 4.71	Angus	4.43 4.35
Grade	4.70 4.68	Grade	4.54 4.40
Scrub	4.68 4.87(?)	Scrub	4.33 4.56(?)
Hereford	4.53 4.14(?)	Hereford	4.22 3.87(?)

"If the views expressed are correct, and they certainly have much in their favor, then with the greatest percentage of heart, blood, and lungs to body weight, Shorthorns stand first in the power of beef production, with the other breeds following in the order of the table."

Assuming the above relationship to be true, it was suggested that by estimation of the hæmoglobin and the red corpuscles of the blood from the percentage of iron, "we would obtain an expression of the embolemic power of blood, which in turn would bear a definite relation to the vital power or beef production of the individual." From the data obtained, however, "this relation seems not to be a simple one."

The author's conclusions from the investigation are as follows:

"(1) That in the quantity of fat produced in the feeding of cattle, breed exerts an influence, and, looking at the question from a commercial standpoint, that Shorthorns and their grades are superior and more profitable than other breeds of cattle.

"(2) That in point of palatability, or rather juiciness of flesh, Angus and Shorthorns are ahead of grades and Herefords, and these again ahead of scrubs.

"(3) That Shorthorns stand first in the power of beef production with Angus, grades, scrubs, and Herefords following in the order given."

Dairy management, A. M. SOULE (*Missouri Sta. Bul. 26, pp. 40*).

Synopsis.—A record of 12 cows, 3 Shorthorns and 9 Jerseys, for 1 year. The yield of milk for the year varied from 3,811 to 8,185 lbs. with the different cows, and the yield of butter from 213.64 to 429.18 lbs. The average cost of food for a cow for 1 year was $35.30. There was a considerable profit from selling milk at 4 cts. a quart or butter at 25 cts. per pound, the profit being considerably larger in the case of the Jerseys.

An individual record is given for the station herd of 12 cows for the year ended July 31, 1894. The herd consisted of 3 Shorthorns and 9 Jerseys, varying in age from 3 to 15 years. During the winter, from November 1 to May 1, the cows were fed in the barn, receiving usually 5 lbs. of bran, 5 lbs. of corn chop, 2 lbs. of oil cake, 2 lbs. of cotton-seed meal, and 20 lbs. of timothy and clover hay per 1,000 lbs. live weight.

During the remaining 6 months they were at pasture and received in addition 4 lbs. of bran per cow daily, with 4 lbs. of corn chop added in May and October.

Composite samples, representing from 2 to 4 milkings, were taken each month, and the fat determined by the Babcock test. The record shows the yield of milk and of butter fat and the percentage of fat in the milk of each cow by months, the amount and cost of the food eaten, the live weight, and the financial results. The latter are based on bran at $12, corn chop at $16, oil cake at $20, cotton seed meal at $18, and hay at $6 per ton, and pasturage at 50 cts. per month. A summary of the results for each cow during the 12 months is given below:

Summary of record for 12 cows for 1 year

Name	Average weight	Total amount produced (Milk)	Average yield per day (Milk)	Cost per 100 lbs. (Milk)	Amount of butter fat produced	Amount of butter made	Cost per pound of butter fat	Cost per pound of butter	From selling milk at 4 cts. per quart (Profit)	From selling butter at 25 cts. per pound (Profit)
Shorthorns	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*	*Lbs.*	*Lbs.*	*Cts.*	*Cts.*		
Spot	1,2[illegible] 0	5,407 0	16 80	[illegible] 4	178 03	213 61	23 [illegible]	19 3	$60 45	$12 10
Emma	1,356 0	5,665 0	15 50	81 9	193 8	239 82	23 2	19	[illegible] 76	13 53
Red	1,202 0	5,812 0	1[illegible] 20	68 8	179 88	215 8	2[illegible] 4	18 6	70 03	1 63
Averages	1,2[illegible] 0	5,611 6	17 10	75 7	18[illegible]	223 10	22 9	19 1	63 41	1[illegible] 09
Jerseys										
Beauty	816 0	6,001 0	18 40	[illegible]1 0	2[illegible]9 31	311 17	11 8	9 8	82 [illegible]3	47 16
Daisie Bates	883 0	5,472 0	1[illegible] 00	[illegible]1 4	260 31	3[illegible] 37	12 9	10 7	[illegible]9 39	44 48
Ramapo	940 0	4,870 0	21 10	47 [illegible]	271 94	326 33	10 1	8 4	82 29	53 95
Bachelor's Girl	973 0	8,118 0	22 [illegible]0	4[illegible] 6	357 65	429 18	9 9	8 2	117 34	71 83
Mattituck	976 0	6,112 0	1[illegible] 70	58 2	270 92	325 10	13 1	10 9	7[illegible] 42	45 59
Mary Herbert	931 0	5,[illegible]13 0	1[illegible] 30	64 0	2[illegible]4 8[illegible]	30[illegible] 78	14 1	11 7	69 71	40 51
Babe	913 0	5,008 0	1[illegible] 70	67 [illegible]	231 01	277 21	11 6	12 2	60 46	35 58
Nimbus	9[illegible]1 0	3,811 0	10 40	7[illegible] 1	178 [illegible]0	214 [illegible]0	16 0	13 3	43 07	24 93
Alphea Elf	917 0	8,185 0	22 40	41 8	337 17	404 60	10 1	8 4	11[illegible] 87	68 94
Averages	918 4	6,021 0	17 [illegible]0	[illegible]6 6	2[illegible] 07	3[illegible] 88	12 [illegible]	10 4	80 43	47 88

"The average yield of milk was 5,927 lbs. The largest quantity was given by Alphea Elf, who produced 8,185 lbs. Next to her came Bachelor's Girl, with 8,118 lbs. to her credit. The smallest yield was from the Jersey heifer, Nimbus, namely, 3,811 lbs. The average number of pounds of butter made was 297.93, the Jersey cow, Bachelor's Girl, heading the list with 429.18 lbs., and closely followed by Alphea Elf with 404.60 lbs. Ramapo stands third, with 326.33 lbs. from a 9-month period. The smallest number was made by the Shorthorn cow, Spot, with 213.61 lbs. . . .

"The average per cent of fat produced by the herd was 4.21. The highest average was made by Daisie Bates, with 4.76, followed by Ramapo with 4.69, and Babe with 4.65. The lowest average was made by Red with 3.11.

"The highest average amount of butter fat produced was made by Bachelor's Girl, with 29.80 lbs. per month and 357.65 lbs. for the year, a little less than a pound a day. Alphea Elf was second, with 28.10 lbs. per month and a total of 337.17 lbs. for the year. Ramapo, Mattituck, and Daisie Bates follow in the order named, with a total production of 271.94, 270.92, 260.31 lbs. of fat, respectively. The highest production of fat in a single month was made by Alphea Elf, with 50.01 lbs., followed by Mary Herbert, who made 49.17. This was at the rate of 2 lbs. of butter per day. . . . It cost $46.40 to keep the large Shorthorn cow Emma, against $27.63 for

the Jersey cow Rapapo. . . . The average cost of keeping a cow, under several disadvantages, in the State of Missouri need not exceed $35.30 a year.

"The cost of producing 100 lbs. of milk varies from 56.6 cts. in the case of the Jerseys to 75.7 cts. in the case of the Shorthorns.

"The cost of the daily ration during the 4 winter months of heavy feeding was 16.8 cts., as compared with 2.4 cts., plus the cost of the pasture, during the 4 summer months. The object in feeding grain in the summer was simply to feed sufficient to sustain a normal flow of milk. The average cost of the daily ration for the year was 10.4 cts. . . .

"In the month of August, 1893, 7,476 lbs. of milk and 318.58 lbs. of butter fat were produced at a cost of $10.75. This was at the rate of 241.16 lbs. of milk and 10.27 lbs. of fat daily; the milk costing 14.3 cts. per 100 lbs. and the fat 3 3 cts. [per pound].

"Comparing this with January, 1894, the sixth month of the lactation period when the heavy grain rations were being fed, there were 6,444 lbs. of milk and 251.57 lbs. of fat made at a cost of $60.16. This was at the rate of 208 lbs. of milk and 8.11 lbs. of fat; the milk costing 93 8 cts. per 100 lbs. and the fat 24 cts. per pound. The highest production of milk and fat at the lowest cost was in the month of August, on grass pasture and a light grain ration.

"The averages show a preference in favor of the Jerseys for milk-selling purposes, and a decided one with regard to the cost and total production of butter fat and butter. . . .

"The greater weight of the Shorthorns and the tendency to lay on flesh made them costlier to feed, and they did not make such good use of the food as the smaller cows."

In addition to the above record, brief popular remarks are made on feeding; the value of keeping a record; conformation of the dairy cow; the use of the separator, Babcock test, and some acid tests in butter making; and a comparison of the daily and composite tests of the milk of 8 cows for 12 days.

Effect of food upon the cost and quality of milk, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 42-77*)

Synopsis.—A comparison on 6 cows in 6 periods of the effect of rations containing different amounts of protein (from 1.3 to 3.76 lbs. per cow daily) on the quantity, quality, and cost of milk. As a rule, the yields of milk and of butter fat increased and the cost of the same decreased with the amount of protein in the ration. The conclusion is that rations with 2.5 to 3 lbs of protein per head daily are more profitable than those with 2 lbs. or less. The composition of the milk, especially the fat, appeared to be favorably affected by the addition of protein up to about 3 lbs., although there was considerable difference in the cows in this respect.

The author reviews work done elsewhere on the effect of food on milk, especially as to the effect of rations containing different amounts of protein. The experiment reported by him is divided into 3 series, with 2 periods in each. Six cows were fed in 2 lots, one lot being fed the narrower and the other the wider ration in the first period, and the rations reversed in the second period. This plan was followed in all 3 series. In the first 2 series the periods were 14 days and in the last 9 days, with preliminary periods of generally 7 days. In series 1 and 2 the coarse fodder consisted of 3 to 4 lbs. of corn stover and corn silage

ad libitum, and in series 3 of corn stover and rowen hay. The grain fed in the different periods and the nutritive ratio and cost of the rations were as follows:

Rations fed to cows in different series and different periods.

	Grain.	Nutritive ratio of ration.	Digestible protein in ration per day.	Cost of ration per day. Total.	Cost of ration per day. Net.[1]
			Pounds.	*Cents.*	*Cents.*
Series 1:					
Ration *a*	3 lbs. wheat bran, 3 lbs. Buffalo gluten feed, and 3 lbs. cotton-seed meal	1: 4.80	2.60	15.95	7.46
Ration *b*	4½ lbs. wheat bran and 4½ lbs. corn meal	1: 10.00	1.30	14.99	9.15
Series 2:					
Ration *a*	3 lbs. wheat bran, 3 lbs. Buffalo gluten feed, and 3 lbs. cotton-seed meal	1: 4.80	2.55	15.97	7.50
Ration *b*	3 lbs. wheat bran, 3 lbs. corn meal, and 3 lbs. cotton-seed meal	1: 5.80	2.24	16.40	8.40
Series 3:					
Ration *a*	3 lbs. cotton-seed meal, 3 lbs. corn meal, and 3 lbs. wheat bran	1: 4.14	2.91	19.38	9.26
Ration *b*	3 lbs. cotton-seed meal, 3 lbs. Chicago gluten meal, and 3 lbs. Buffalo gluten feed	1: 3.08	3.76	20.13	9.00

[1] Making allowance for value of manure.

At the beginning of the third series one of the cows was replaced by a new one.

Composite samples of the milk of each cow were made for 3 days of each week, and the cows were weighed weekly. The experiment lasted from January 16 to April 30. Full data are given, including analyses of the milk and feeding stuffs, and the barn temperatures. A summary follows:

Yield and cost of milk and butter on different rations.

	Protein fed per day.	Average live weight.	Milk. Total yield.	Milk. Total cost per quart.	Milk. Net cost per quart.	Butter fat. Total yield.	Butter fat. Total cost per pound.
	Pounds.	*Pounds.*	*Quarts.*	*Cents.*	*Cents.*	*Pounds.*	*Cents.*
Series 1:							
Ration *a*	2.60	878	837.76	1.60	0.77	82.17	16.30
Ration *b*	1.30	867	756.51	1.66	1.02	67.37	18.67
Series 2:							
Ration *a*	2.55	871	758.60	1.77	0.84	78.20	17.12
Ration *b*	2.24	873	725.04	1.90	0.97	70.00	19.66
Series 3:							
Ration *a*	2.91	874	473.44	2.21	1.06	45.25	23.12
Ration *b*	3.76	862	524.94	2.11	0.93	50.95	21.69

In the first series a larger total yield of milk and of butter fat was produced on the narrow ration (*a*), and the cost of these per quart and per pound, respectively, was lower than on the wide ration (*b*).

"The 6 cows fed on ration *b* showed an average decrease of 11 lbs. in live weight. It is certain, however, that more flesh and fat were lost than the scales specified, for during series 1, ration *b*, the animals looked thin and had every appearance of being improperly nourished. In all probability flesh and fat were replaced by water. It is very clear, then, that a ration containing 2.60 lbs. of protein was more economical to feed than one containing approximately one half that amount."

In the second series the only difference between the rations was that the 3 lbs. of Buffalo gluten feed in ration *a* was replaced by 3 lbs. of corn meal in ration *b*. On ration *a* 35 qts. more milk and 8 lbs. more butter fat were produced than on ration *b*, and at a cost of 0.13 ct. less per quart of milk and 1.5 cts. less per pound of butter fat. "These figures show the butter and milk producing power of the Buffalo gluten feed over the corn meal, or, more correctly speaking, the influence of even 0.25 lb. more of digestible protein, and also possibly the effect of the increased fat, in the daily fodder ration."

In the third series, although the periods lasted only 9 days and the rations in both periods were unusually rich in protein, 51 qts. more milk and 5.7 lbs. more butter fat were produced on the richer ration, and at a cost of 0.1 ct. less per quart of milk and 1.43 cts. less per pound of butter fat.

"So far, then, as this one set of experiments is concerned, the largest amount of protein fed daily, viz, 3.76 lbs., was the most economical. It must be admitted that in feeding so much protein the animal is asked to do her best, and it is a question for how long a time she would be able to continue. The writer believes, however, that during the late fall and winter months cows that are in good condition can be fed from 2.5 to 3 lbs. of digestible protein daily with profit. It probably would not be advisable to feed over 2.5 lbs. daily to animals that are soiled during the spring, summer, and early autumn.

"Farmers are especially cautioned not to feed too large an amount of grain during the summer that contains a high percentage of fat. A large amount of fat in the daily ration at this season tends to overheat the animal and produce inflammation of the milk glands. Among such grains may be mentioned cotton-seed meal, Buffalo gluten feed, cream gluten meal, King gluten meal, etc. Not above 4 or 5 qts. of the Buffalo gluten feed or 2 qts. of any of the others should enter into any one daily grain ration during the summer months.

"While 2.5 lbs. or more of protein have been shown to be economical in the present experiment, the writer believes, with Wolff, that it is also necessary to keep up the flow of milk for the longest possible time. The demands upon the cow that produces 10 to 12 qts. of milk daily are severe, and she must be well supplied with sufficient digestible protein to meet these demands."

The average composition of the milk of each cow on each of the rations is given in the table on the following page.

In the first series there was a varying increase in the total solids and fat in case of 5 cows on the richer ration. This was true in case of 4 cows in the second series, when the difference between the amount of protein fed in the 2 periods was much smaller. In both series the relation of the fat to the solids-not-fat was closer on the richer ration in case of 4 cows.

"The cows differed in what may be termed their susceptibility to the influence of the different fodder rations. [In series 1] the percentage of fat increase in the milk in case of cows Sarah and Nora was not so great as in case of the first 3 cows; while in case of Nellie the extreme food changes seemed to have had a comparatively small influence on the composition of the milk. The animal appeared, however, to feel more than any of the other cows the bad effect of the improperly combined ration *b*. Her whole general appearance told of a non-suitable food supply. This cow illus-

trates quite clearly the fact that the composition of the milk of different cows can be differently affected by the same food combinations. Although she gave every appearance of receiving improper nourishment, she still maintained the quality of her milk."

Average composition of milk produced on different rations

	Series 1			Series 2			Series 3		
	Ration *a* (2.6 lbs protein)	Ration *b* (1.3 lbs protein)	Percentage increase of *a* over *b*	Ration *a* (2.55 lbs protein)	Ration *b* (2.24 lbs protein)	Percentage increase of *a* over *b*	Ration *a* (2.91 lbs protein)	Ration *b* (3.76 lbs protein)	Percentage increase of *b* over *a*.
Nettie	*Per ct.*	*Per ct.*		*Per ct.*	*Per ct.*		*Per ct.*	*Per ct.*	
Total solids	13.10	13.00	0.77	13.58	13.21	+2.80	13.47	13.31	−1.19
Fat	4.18	3.48	20.11	4.51	4.25	6.12	4.40	4.05	−7.95
Solids not fat	8.92	9.52	−6.30	9.07	8.96	+1.23	9.07	9.26	+2.09
Relation of fat to solids not fat	1 : 2.13	1 : 2.74		1 : 2.01	1 : 2.11		1 : 2.06	1 : 2.29	......
Mary									
Total solids	14.12	13.95	1.20	14.21	14.29	−0.56	14.11	14.00	−0.77
Fat	5.10	4.40	+15.90	5.08	5.15	1.36	4.80	5.00	+4.17
Solids not fat	9.03	9.55	−5.44	9.13	9.14	0.11	9.31	9.00	−3.33
Relation of fat to solids not fat	1 : 1.77	1 : 2.17		1 : 1.80	1 : 1.77		1 : 1.94	1 : 1.80	
Gem									
Total solids	13.31	13.37	−0.45	13.56	13.54	0.15	13.13	13.07	−0.45
Fat	4.69	4.03	+16.38	4.80	4.70	+2.08	4.30	4.20	−2.33
Solids not fat	8.62	9.34	−7.71	8.76	8.84	0.90	8.83	8.87	+0.45
Relation of fat to solids not fat	1 : 1.84	1 : 2.32		1 : 1.83	1 : 1.88		1 : 2.05	1 : 2.11	
Sarah[1]									
Total solids	13.78	13.26	+3.92	13.45	12.96	3.77	13.26	13.90	+4.83
Fat	4.62	4.34	+6.45	5.00	4.35	+14.94	4.40	4.75	+3.28
Solids not fat	9.16	8.92	+2.69	8.45	8.61	−1.89	8.66	9.15	+6.40
Relation of fat to solids not fat	1 : 1.98	1 : 2.06		1 : 1.69	1 : 1.98		1 : 1.88	1 : 1.93	
Nora									
Total solids	13.78	13.43	2.61	13.74	13.55	+1.42	13.70	13.61	−1.09
Fat	4.[illegible]	4.33	4.[illegible]	4.93	4.35	11.76	4.20	4.30	+2.38
Solids not fat	9.[illegible]	9.10	1.76	8.81	9.20	−4.24	9.[illegible]	9.31	−2.61
Relation of fat to solids not fat	1 : [illegible]	1 : 2.10		1 : 1.79	1 : 2.11		1 : 2.28	1 : 2.17	
Nellie									
Total solids	14.13	1[illegible].86	+1.[illegible]	14.23	14.22	−0.07	14.69	14.70	+0.47
Fat	4.[illegible]8	4.38	−[illegible]	4.[illegible]	4.[illegible]	7.06	4.30	4.70	+9.30
Solids not fat	[illegible].8	9.48	3.90	9.68	9.97	2.91	10.39	10.06	−3.17
Relation of fat to solids not fat	1 : 2.30	1 : 2.1[illegible]		1 : 2.13	1 : 2.36		1 : 2.42	1 : 2.14	

[1] Replaced by another cow in third series.

In the third series the result was less regular, but the percentage composition was frequently lower on the richer ration. In other words, "when 3 lbs. of protein was fed in the daily ration there was an indication that its influence upon the quality of the milk ceased to be felt."

The average composition of the milk of all the cows in each period is also calculated on the uniform basis of 13 per cent of total solids. These figures, with some of the other results of the experiment, are concisely summarized in the following table:

Average results for 6 cows.

	Average digestible nutrients consumed daily per 1,000 lbs. live weight.[1] Protein.	Total organic matter.	Nutritive ratio.	Total amount of milk produced on basis of 13 per cent solids.	Total solid matter in milk.	Total butter fat in milk.	Average composition of milk. Total solids.	Solids-not-fat in milk with 13 per cent solids.	Butter fat in milk with 13 per cent solids.
Series 1:	*Pounds.*	*Pounds.*		*Pounds.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*	*Per ct.*
Ration *a*	3.00	15.27	1:4.80	1,897.70	246.70	82.20	13.70	8.63	4.33
Ration *b*	1.50	15.27	1:10.00	1,685.30	219.25	67.66	13.47	9.01	3.99
Percentage increase *a* over *b*				+12.60	+12.52	+21.49	+1.71	—4.10	+8.52
Series 2:									
Ration *a*	2.93	15.65	1:4.80	1,731.30	225.00	78.44	13.80	8.47	4.53
Ration *b*	2.57	15.87	1:5.80	1,634.50	212.70	70.30	13.63	8.70	4.30
Percentage increase *a* over *b*				+5.92	5.78	+11.58	+1.25	−2.67	+5.35
Series 3:									
Ration *a*	3.34	16.32	1:4.40	1,075.20	139.77	45.30	13.73	8.80	4.20
Ration *b*	4.32	16.03	1:3.06	1,194.80	155.31	50.76	13.77	8.75	4.25
Percentage increase *b* over *a*				+11.10	+11.12	+12.05	±	±	+1.19

[1] Calculated from the average weight of 871 lbs.

In commenting on the experiment the author points out some weak points, such as variation in the temperature of the stable, which was not artificially heated; sampling the milk for 3 days each week instead of 4 or 5 days; using different coarse fodder in the third series from that used in the first 2 series; making the last series too short; and lack of uniformity in the fat content of the rations.

"The experiment certainly indicates that rations so put together as to contain 2.5 to 3.5 lbs. of digestible protein can be fed with greater profit to the farmer than rations containing 2 lbs."

Creamery record, 1893-'94 (*Massachusetts State Sta. Rpt. 1894, pp. 78-87*).—This gives a statement of the feeding stuffs used, their market price, composition, with reference to fertilizing ingredients, average composition of the milk by months, fertilizing constituents of cream, the value of the cream, the amount received for the cream at the local creamery, and the cost of skim milk on the basis of whole milk at 3 cts. per quart.

"The net cost of feed for 1 qt. of cream amounted in 1893 to 5.98 cts., and in 1894 to 7.17 cts.

"The value received for 1 space of cream varied in 1893 from 3.50 to 4.25 cts., with an average of 3.93 cts.; in 1894 from 3.10 to 4 cts., with an average of 3.52 cts., which amounted per quart (average) in 1893 to 13.36 cts., and in 1894 to 11.97 cts.

"The number of quarts of milk required to produce 1 space of cream in 1893 was 1.88 and in 1894, 2.08; or 6.39 qts. of whole milk to produce 1 qt. of cream in 1893, and 7.07 qts. of whole milk to produce 1 qt. of cream in 1894."

Further contribution to the question of the action of feeding stuffs with acid properties on the organism, especially on the skeleton, H. WEISKE (*Ztschr. phys. Chem., 20 (1895), p. 595; abs. in Chem. Ztg., 19 (1895), No. 70, Repert., p. 252*).

Action of copper on the animal organism, M. KLEMPTNER (*Pharm. Ztschr. Russland, 33, pp. 485–487; abs. in Chem. Centbl., 1894, II, p. 620; and Jour. Chem. Soc. London, 48 (1895), Aug., p. 321*).

Absorption of fat, V. HARLEY (*Jour. Physiol., 18 (1895), pp. 1–14; abs. in Jour. Chem. Soc. London, 48 (1895), Aug., p. 320*).

On the influence of the addition of fat as well as starch on the utilization of food, etc., A. WICKE and H. WEISKE (*Ztschr. phys. Chem., 21 (1895), p. 42; abs. in Chem. Ztg., 19 (1895), No. 70, Repert., p. 253*).

On the digestibility of vegetable feeding stuffs containing pentosans, H. WEISKE (*Ztschr. phys. Chem., 20 (1895), p. 489; abs. in Chem. Ztg., 19 (1895), No. 50, Repert., p. 189; and Ztschr. angew. Chem., 1895, No. 18, p. 556*).—In experiments with sheep the digestibility of the pentosans was found to be higher than was expected. The average percentage of digestibility of the pentosans in hay and oats was 65.1. In experiments with dogs the average coefficient of digestibility was 53.81. The digestibility of the pentosans in oats agreed quite closely in case of sheep and dogs, and was somewhat less than that of meadow hay.

Tables of digestibility of American feeding stuffs, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 459–469*).—This is a compilation of the digestion experiments made in the United States with ruminants and with swine, showing in each case the maximum, minimum, and average coefficients obtained.

On the composition and valuation of the different mill products of wheat, M. DENNSTEDT and F. VOIGTLÄNDER (*Forschungsber. Lebensmtl. Hyg. Chem., 1895, No. 2, p. 228; Chem. Ztg., 19 (1895), No. 82, p. 292*).

Miscellaneous fodder analyses, C. A. GOESSMANN (*Massachusetts State Sta. Rpt. 1894, pp. 388–406*).—Analyses with reference to food ingredients of the following materials: Quaker self-raising buckwheat flour, Hecker's hominy, macaroni, farina, condensed milk, gelatin, baking powder, peanut meal, cotton-seed meal, cotton-seed bran, Chicago gluten meal, King gluten meal, Iowa gluten meal, Atlas meal, barley meal, Buffalo gluten feed, Peoria gluten feed, golden gluten, Chicago maize feed, Chicago germ feed, combination horse feed, rye feed, peanut feed, oat feed, ground oats, wheat bran, oil cake, peanut cake, peanut husks, meat meal, soja beans (different varieties at different stages of growth), rowen hay, carrots, beets, potatoes raised with different fertilizers, apple pomace, and corn, oats, and barley chop, and corn and oat chop. The fertilizing ingredients are also given for the following materials: Peanut meal, cotton-seed meal, cotton-seed bran, Atlas meal, peanut husks, peanut feed, meat meal, rowen hay, carrots, beets, and potatoes raised with different fertilizers. The analyses are followed by a discussion on commercial feeding stuffs, calling attention to the manurial value of different feeding stuffs and the valuation of fodder articles, and making suggestions for the economical selection of feeding stuffs

Analyses of foods and feeding stuffs, M. B. HARDIN (*South Carolina Sta. Rpt. 1894, pp. 11, 12*).—Tabulated analyses (food constituents) of wheat bran, rye, barley, oats, silage, cotton-seed meal, mangel-wurzels, sugar beets, and butter.

Compilation of analyses of fodder articles, fruits, sugar-producing plants, dairy products, etc., C. S. CROCKER (*Massachusetts State Sta. Rpt. 1894, pp. 427–458*).—This is a compilation of analyses made under the direction of C. A. Goessmann from 1868 to 1895.

Studies on flour and bread: IX. Effect of human digestive fluids on stale and freshly baked bread, E. JUNGMANN (*Arch. Hyg., 24, No. 2, pp. 109–123*).

On the analyses of flesh extract and flesh peptone, A. STUTZER (*Ztschr. angew. Chem., 1895, No. 18, pp. 529, 530*).

Danger of spontaneous combustion with feeding stuffs moistened with molasses (*L'Engrais, 10 (1895), No. 38, p. 904*).

The manufacture of potato cake, NIVIÈRE and HUBERT (*Abs. in Jour. [British] Bd. Agr., 2 (1895), No. 2, p. 190*).—Brief reference to a process of grating, pressing and drying, and thus preserving potatoes.

The feeding of potatoes to farm animals, A. GIRARD (*Ind. Lait., 20 (1895), No. 23, pp. 185–187*).

Use of potatoes for dairy cows, B. KOHLER (*Ind. Lait., 20 (1895), No. 21, pp. 170, 171*).

The feeding of meat meal to calves, A. GOUIN (*Ind. Lait., 20 (1895), No. 20, pp. 154–156*).

Shorthorn and Hereford cattle, J. L. THOMPSON (*Agl. Gaz. N. S. Wales, 6 (1895), No. 5, pp. 349–360, pls. 5*).— Historical sketch of these two breeds and scale of points for Shorthorns.

The straw and chaff of oil-producing plants, L. DANGER (*Fuhling's landw. Ztg., 44 (1895), No. 16, pp. 515–518*).—A popular article treating of their use as stable litter or bedding.

A brief practical talk about some of the principles involved in feeding farm animals, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 14–29*).—This paper, as the title indicates, is a popular article on the principles of feeding, with directions for the calculation of rations, and suggested rations for milch cows and growing meat stock, for growing lambs in winter, for pigs, and for farm horses.

A contribution to the study of rational feeding, E. MARCHI (*Staz. Sper. Agr. Ital., 28 (1895), No. 6, pp. 393–405*).—An account of experiments in feeding 2 calves about a year old.

Feeding tests with different breeds of beef cattle, P. SCHWEITZER (*Missouri Sta. Bul. 28, pp. 39, pls. 8*).—This is a shorter account of the experiment described in Bulletin 24 of the station, with the conclusions from the study of the composition of the flesh of cattle, described in Bulletin 25 of the station, both of which are abstracted above (pp. 324, 327).

Feeding cotton seed, A. M. SOULE (*Breeders' Gaz., 1895, Aug. 7, p. 85*).—The feeding of cotton seed and its products to cattle, hogs, and sheep is discussed.

Wheat as food for cattle, L. DANGER (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 17, pp. 244–246*).

A feeding experiment with molasses, VIBRANS (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 34, pp. 473, 474*).

Largest milk and butter yields of Jersey cows (*Amer. Agr. (middle ed.), 1895, Oct. 5, p. 282*).

The selection of dairy cows, A. LEROY (*Ind. Lait., 20 (1895), Nos. 21, pp. 171, 172; 22, pp. 179, 180*).

Records of Holstein-Friesian cows (*Cult. and Country Gent., 1895, Oct. 10, p. 738*).—The official tests of 25 cows are used as a basis for estimating the cost of production of butter from this breed.

Concerning the milking qualities of Breitenburg cows, H. BREYHOLZ (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 36, pp. 491–494*).

Slaughter experiments with pigs (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 36, pp. 494–496*).

Report on fish culture in the Department of Somme, BROCCHI (*Bul. Min. Agr. France, 14 (1895), No. 2, pp. 172–186*).

Marine stations, GILCHRIST (*Agl. Jour. Cape Colony, 8 (1895), No. 18, pp. 472–474*).—A statement of the purposes of these stations, with special reference to the fishing industry.

Trout culture, F. MATHER (*Pop. Sci. Monthly, 1895, Oct., pp. 749–761, figs. 7*).

DAIRYING.

Dairyman's report, J. W. HART (*South Carolina Sta. Rpt. 1894, pp. 32–37*).—The dairy building recently built at the station is briefly described and experiments in butter making and cheese making are reported.

"An experiment to determine the efficiency of churning whole milk compared with using the hand separator and churn was undertaken in August and September. . . .

"Before being divided the milk was thoroughly mixed. One portion was then separated by a hand separator and the cream was churned as soon as it had ripened. The whole milk portion was allowed to turn to clabber before being churned. In churning the whole milk the conditions were such as to secure the best possible yield, and it was found that 14.06 per cent, or about one-seventh of the fat present in the milk, was not recovered in the butter. In using the centrifugal separator and the churn, 7.53 per cent of the total fat of the milk was not recovered in the butter. This is largely owing to the fact that the churning temperature, 68°, which was the lowest that could be obtained without ice, was entirely too high for the best results in churning cream.

"As soon as the steam fitting at the dairy was done cheese making was commenced. Between September 25 and October 16 cheese was made on 10 days. From 4,155.25 lbs. of milk 476.25 lbs. of green cheese were made, an average of 8.72 lbs. of milk being required to make 1 lb. of cheese. From the records kept it appears that the milk from which the cheese was made contained 186.41 lbs. of fat."

The Babcock test vs. the "space" system as the basis for payment in Massachusetts creameries, J. B. LINDSEY (*Massachusetts State Sta. Rpt. 1894, pp. 93–103*).—This is practically the same as an article published elsewhere (E. S. R., 7, p. 67), the full data being given for the 165 patrons from whom data were collected.

"The results obtained fully confirm the investigations made along this line elsewhere.

"They show conclusively that the space of cream is of very variable composition, and is not a true measure of the value of cream for butter purposes. The value of cream for butter, other things being equal, depends entirely upon the amount of butter fat it contains. The number of spaces of cream required to make a pound of butter depends also upon the butter fat content of the cream."

Analyses of milk (*Massachusetts State Sta. Rpt. 1894, pp. 407, 408*).—Analyses of 40 samples of milk sent to the station for examination. No description of the samples is given.

Chemical analysis of koumiss, A. K. ALLIK (*Inaug. Diss. Jurjew, 1895; abs. in Chem. Ztg., 19 (1895), No. 56. Repert., p. 203*).

A contribution to the bacteriology of the ripening of soft cheeses, E. MARCHAL (*Ann. Soc. Micr. Belge, 19 (1895), No. 2, pp. 29–75, pl. 1*).

What becomes of the casein in lactic acid fermentation? G. KABRHEL (*Ztschr. Hyg., 1895, p. 392; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 12, pp. 439, 440*).

Microörganisms of bitter milk and cheese, E. VON FREUDENREICH (*Ann. Micr., 7 (1895), pp. 1–14; abs. in Jour. Roy. Micr. Soc. England, 1895, No. 3, pp. 3, 49, 350*).

On the bacteriology of cheese, J. HENRICI (*Diss. Basel, 1894; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 1, pp. 40, 41; and in Chem. Centbl., 1895, II, No. 13, p. 700*).

Dairy bacteriology, E. VON FREUDENREICH (*London: Methuen & Co., 1895, pp. 122; translated by J. R. A. Davis; reviewed in Nature, 1895, p. 220*).

Of what service has bacteriology been to dairying up to the present time? G. ZIRN (*Landw. Wochenbl. Schles. Holst., 45 (1895), Nos. 28, pp. 394–396; 29, pp. 412–414*).

Bacteriological investigation at the dairy station at Fribourg, A. EVÉQUOZ (*Ind. Lait., 20 (1895), No. 26, pp. 201, 202*).

Investigations on the sterilization of milk and lactic fermentation, P. CAZENEUVE (*Jour. Pharm. et Chim., ser. 6, 15 (1895), No. 10, pp. 489–496, figs. 3*).

A pasteurizing apparatus for milk, W. WETTERLING (*Ztschr. angew. Chem.*, *1895*, *No. 18*, *p. 557*).—A patented device.

A rapid test for milk, L. CUNIASSE (*Ind. Lait.*, *20* (*1895*), *No. 22*, *p. 177*).

The creamometer for determining the fat in pasteurized milk, P. CAZENEUVE and E. HADDON (*Ind. Lait.*, *20* (*1895*), *No. 23*, *pp. 187*, *188*).

Time of curdling of rich and poor milk, E. MESSERLY (*Ind. Lait.*, *20* (*1895*), *No. 24*, *p. 193*).

Formic aldehyde, its detection in milk and value as a preservative, R. T. THOMPSON (*Chem. News*. *71* (*1895*), *No. 1852*, *pp. 247*, *248*).

A cold process of condensing milk (*Rural New Yorker*, *1895*, *July 27*, *p. 509*).—A proposition to remove a part of the water by freezing.

The preparation of foaming or gaseous milk from centrifugal skim milk, C. BESANO (*Staz. Sper. Agr. Ital.*, *28* (*1895*), *No. 5*, *pp. 317–321*).—After pasteurization the milk is charged with carbonic-acid gas and the author states that the resulting drink is agreeable.

The preparation of milk for children, BACKHAUS (*Fühling's landw. Ztg*, *44* (*1895*), *No. 12*, *pp. 369–377*).

A patent milk can (*Deut. landw. Presse*, *22* (*1895*), *No. 73*, *p. 661*, *fig. 1*)

The utilization of buttermilk, E. MER (*Ind. Lait.*, *20* (*1895*), *No. 20*, *p. 153*).

The utilization of whey, F. JEAN (*Ind. Lait.*, *20* (*1895*), *No. 19*, *pp. 117*, *118*).

Experiments in dry salting and brine salting butter, F. BLERSCH (*Agl. Jour. Cape Colony*, *8* (*1895*), *No. 16*, *pp. 411*, *412*)—The tests related to the flavor, texture, color, and content of salt in butter.

Analyses of Australian butter, F. S. MARRACCI (*Staz. Sper. Agr. Ital.*, *28* (*1895*), *No. 6*, *pp. 390–392*).

Profitable dairying on large and small estates, H HUCHO (*Nutzbringende Milchwirtschaft im Gross- und Kleinbetriebe. Leipzig. H. Voigt*, *1895*).—Reviewed in *Fühling's landw. Ztg.*, *44* (*1895*), *No. 17*, *pp. 527–531*).

The relation between the fat content of the milk and of the Limburger cheese made from it, F. G. HERZ (*Chem. Ztg.*, *19* (*1895*), *No. 79*, *pp. 1787*, *1788*).

Gorgonzola and Stilton blue or molded cheese, J. LONG (*Cult. and Country Gent.*, *1895*, *Aug. 8*, *pp. 587*, *588*).—Methods of manufacture.

The manufacture of Laguiole cheese, E. MARRE (*Prog. Agr. et Vit.*, *12* (*1895*), *No. 30*, *pp. 97–103*, *figs. 11*).

Various kinds of fancy cheese, J. LONG (*Cult. and Country Gent.*, *1895*, *Aug. 15*, *pp. 603*, *604*).—This treats of the manufacture of several French cheeses.

A contribution to the chemistry of cheese making, C. PICCARDI (*Staz. Sper. Agr. Ital.*, *28* (*1895*), *No. 6*, *pp. 406–412*).—Analyses of cows' and sheep's milk.

Determination of the ripeness of cheese, C. V. MUKAKOSY (*Ind. Lait.*, *20* (*1895*), *No. 26*, *p. 203*).

Cheese and butter as possible carriers of typhoid and cholera infection, ROWLAND (*Brit. Med. Jour.*, *1895*, *No. 1799*; *abs. in Centbl. Bakt. und Par. Med.*, *18* (*1895*), *No. 7*, *p. 204*).

Dairying in Denmark, F. DELUE and S. TANGHE (*Bul. Agr. Belg.*, *10* (*1894*), *No. 4–5*, *pp. 315–393*, *figs. 20*).

Dairying in North Germany, F. DELUE and S. TANGHE (*Bul. Agr. Belg.*, *10* (*1894*), *No. 4–5*, *pp. 394–423*, *figs. 14*).

Dairying in Holland, F. DELUE and S. TANGHE (*Bul. Agr. Belg.*, *10* (*1894*), *No. 4–5*, *pp. 424–431*).

Report of the dairy institution at Proskau for the year ended March 31, 1895, J. KLEIN (*Chem. Ztg.*, *19* (*1895*), *No. 75*, *p. 1685*).

STATISTICS.

Seventh Annual Report of Kansas Station for 1894 (*Kansas Sta. Rpt. 1894, pp. 46*).—This includes synopses of the bulletins issued during the year, outlines of the work of the year in the different departments of the station, and the treasurer's report (with inventory) for the fiscal year ending June 30, 1894. Preliminary work in pumping and storing water and in irrigating various crops at Garden City is reported.

Report of the director of Massachusetts State Station for 1894 (*Massachusetts State Sta. Rpt. 1894, pp. 7-1*).—A general review of the work of the year, and financial report for the year ending December 20, 1894.

Eighth Annual Report of Nebraska Station for 1894 (*Nebraska Sta. Rpt. 1894, pp. 31, figs.*).—This includes brief summaries of the work of the year in the different departments of the station and a report of the treasurer for the fiscal year ending June 30, 1894.

Seventeenth Annual Report of North Carolina Station for 1894 (*North Carolina Sta. Rpt. 1894, pp. 504*).—This covers the work for the year ended December 31, 1894, already noted in the eighth biennial report of the station, and includes the bulletins published during the year 1894.

Seventh Annual Report of South Carolina Station for 1894 (*South Carolina Sta. Rpt. 1894, pp.*).—This contains brief summaries of the work of the year under the heads of reports of the board of control, director, chemist, agriculturist, horticulturist, and dairyman.

Reports of director and treasurer of Virginia Station for 1894 (*Virginia Sta. Rpt. 1894, pp. 12*).—A list of bulletins published and financial statement for the fiscal year ending June 30, 1894, with reports of heads of departments on progress of work.

Report of the Statistician for August, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 129, n. ser., pp. 4*).—This issue contains the crop report for August, 1895; transportation rates for farm produce in general and for potatoes "shipped from the sections where they constitute a surplus crop to the regions where they are consumed or reshipped to consumers," and compiled notes on crops in European countries.

Laws relating to the State Board of Agriculture (*The State Agl. College and the Agl. Expt. Stas. of Colorado, 1894, Aug. 1, pp. 9*).—Compiled by authority of the State Board of Agriculture.

Longerenong Agricultural College (*Melbourne Weekly Times, abs. in Agl. Jour. Cape Colony, 8 (189), No. 17, pp. 4 4.8*).—A statement of experiments in progress.

Scheme of technical instruction, M. J. R. DUNSTAN (*County Council of Notts, England, p. 28*).—This pamphlet outlines the course of instruction conducted in Notts in agriculture and other technical subjects.

Progress of agricultural education, J. WILSON (*Agl. Students' Gaz., 1895, July, pp. 140-145*).—This article deals with agricultural education in England.

Agricultural returns for Great Britain in 1894 (*Bd. Agr. [British] Rpt. 1894, pp. 246*).—This report comprises full statistical returns relative to the crops and live stock of the United Kingdom and the British possessions, with a summary of similar statistics from foreign countries.

Agricultural exports and imports in Denmark during 1894, F. BECK (*Tidsskr. Landøkon., 14 (189), pp. 165-183*).

Costa Rica consular report, R. VILLAFRANCA (*Informes Consulares. San José de Costa Rica: Tipografía Nacional, 189 , pp. 178*).—Contains reports of consuls at the different stations.

Crops in Denmark during 1894, K. HANSEN (*Tidsskr. Landøkon., 14 (1895), pp. 39-58*).

Danish agriculture in 1894, J. C. LA COUR (*Tidsskr. Landøkon., 14 (1895), pp. 1-38*).

Progress report on the agricultural industries of Trinidad, J. H. HART (*May, 1895, pp. 9*).—A descriptive list of trees, shrubs, and plants suitable for Trinidad of value in manufacture, commerce, and the arts.

The climax of agricultural disaster, W. E. BEAR (*Fortnightly Review, 1895, Sept., pp. 405–414*).—A review of the present condition of English agriculture.

Wheat prices and wheat supply, R. F. CRAWFORD (*Jour Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 351–365*).—An examination into the causes of the decline in the price of wheat.

Select farms in the Darlington district, J. H. DUGDALE (*Jour Roy Agl. Soc. England, ser. 3, 6 (1895), No. 23, pp. 483–529*).—Notes on the methods of management of 15 farms near Darlington, England.

Report of the agricultural chemical experiment station of the Agricultural Society of the Province of Saxony at Halle, 1894, M. MAERCKER (*Chem. Ztg., 19 (1895), No. 64, pp. 1455, 1456*).

Report of the State agricultural station at Gembloux (Belgium), 1894, A. PETERMANN (*Chem. Ztg., 19 (1895), No. 73, pp. 1629, 1630*).

Annual report of the agricultural-chemical station at Köslin for 1894, P. BASSLER (*Wochenschr. Pom. ökon. Ges., 25 (1895), Nos. 15, pp. 198, 199; 16, pp. 205–210; 17, pp. 217–219*).

Report of eighteenth annual meeting of the American Microscopical Society (*Amer. Micr. Jour., 16 (1895), No. 9, pp. 276–285*).—A brief report of the meeting held at Ithaca, New York, August 21–23, 1895.

Society for the Promotion of Engineering Education (*Science, n. ser., 2 (1895), No 39, pp. 390–391*).—A report is given of the meeting at Springfield, Massachusetts. September 2–4, 1895.

President's address before the British Association for the Advancement of Science (*Chem. News, 72 (1895), No. 1868, pp. 127–136; No. 1869, pp. 139–141*).

Agricultural maps, H. DEKOKER (*Ing. Agr. Gembloux, 5 (1895), No. 13, pp. 558–565*).—A statement of what data should be noted on such maps.

Popular dictionary of practical agriculture, PERCHEROU and DEBREUIL (*Dictionaire populaire d'agriculture pratique. Paris: Abajones-Azerolier, 1 (1895), pp. 160*).

NOTES.

CONNECTICUT STATE STATION.—A greenhouse 50 ft. long by 20 ft. wide, with a lean-to house 10 ft. by 25 ft., is being erected to enlarge opportunity for study of the fertilizer requirements of crops grown under glass.

CONNECTICUT STORRS STATION.—C. B. Lane was recently appointed assistant agriculturist of the station, and O. F. Tower, Ph. D., assistant chemist.

IDAHO STATION.—The exhibit made by the station at the Spokane Fruit Fair was awarded a gold medal for the largest and best display of general farm products.

NEBRASKA STATION.—E. E. Nicholson, assistant chemist, has been appointed to an instructorship in chemistry in the University of Minnesota, and has been succeeded by R. S. Hiltner. R. A. Emerson, a student in the university, becomes assistant in the horticultural department.

NEVADA STATION.—On October 1 the State, through the State Agricultural Society, transferred the Agricultural Fair Grounds to the board of control of the station for farm experimental use. This gives the station a fine tract of well-watered land—about 82 acres.

CORNELL UNIVERSITY.—The State is now constructing on the grounds of Cornell University a veterinary college at a cost of $150,000. The college work will be largely in instructional lines, though it is expected that original investigations will be carried on so far as conditions will permit.

NORTH CAROLINA STATION.—The station has established a poultry division, active work to begin December 1, with F. E. Hege, of Newbern, North Carolina, as manager. Special attention will be given to the study of diseases and insects affecting fowls, methods of handling and shipping to market all poultry products, and best breeds for different parts of the State.

SOUTH DAKOTA STATION.—As a result of recent changes the station staff becomes as follows: L. McLouth, president, *ex officio;* R. L. Slagle, analytical chemist; J. M. Trueman, dairy science; T. A. Williams, botanist; D. A. Cormack, veterinarian; N. E. Hansen, horticulturist; D. McLaren, entomologist, and E. F. Hewit, secretary and accountant.

WYOMING COLLEGE.—Capt. C. A. Varnum, 7th U. S. Cavalry, has been appointed professor of military science and tactics in the college.

PERSONAL MENTION.—Henri Baillon, professor of botany in the Faculté de Médecine, of Paris, and well known through his *Histoire des Plantes*, died July 21, 1895, aged 67 years.

Dr. M. Miyoshi has been chosen professor of botany of the University of Tokyo.

Baron F. von Müller and F. Cohn have been chosen members of the Botanical Section of the Academy of Sciences in place of the late Messrs. Pringsheim and De Saporta.

Julien Vesque, noted for his physiological and botanical investigations relative to their application to agriculture and gardening, died recently in France.

EXPERIMENT STATION RECORD.

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Elsewhere in this number of the Record abstracts are given of the course of lectures delivered in this country in 1893 by Sir Joseph Henry Gilbert on Agricultural Investigations at Rothamsted, England, During a Period of Fifty Years.[1] The account of these investigations, presented in concise and systematic form, with résumés of the progress of agricultural science along special lines, constitutes a most valuable contribution to the literature of agricultural investigation.

In reviewing the work done at Rothamsted the casual reader can hardly fail to be impressed with the permanency and thoroughness of the work; the limited number of lines undertaken, although the work extends over fifty years; the close coöperation between the work in the field and stable and in the laboratories; and the completeness of the records.

The Rothamsted investigations probably furnish the best examples of what may be accomplished with field experiments continued over a series of years and supplemented by laboratory work; and they have probably taught more than any other set of experiments as to the best methods for such work. It should be remembered that the work was commenced at a time when agricultural investigation was in its infancy, and the methods were in very crude form. By patient plodding the effort has been to develop these methods gradually, and to establish principles which would bear the test of subsequent investigation.

The field work is unique. Land especially adapted to experimental purposes was selected, and permanent plats laid out. A plan was developed for each set of experiments, which was only varied as experience suggested. Experiments thus inaugurated were continued through thirty, forty, and even fifty years without interruption. The shortest experiment reported upon lasted five years, and fully two-thirds of the experiments lasted over twenty successive years.

Except at the very first, there is no evidence of a vacillating policy or an inclination to abandon one line of work in order to take up some new one. The belief was in the final effectiveness of continued effort

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. No. 22.

along a given line. Once organized and entered upon, the investigation was continued without interruption until definite, well-established results were attained. Whether in the investigations of questions in animal or plant nutrition, in nitrification, or in the study of the soil and drainage waters, this commendable policy is evident. We know now that such long periods are not always necessary in order to secure reliable results, and we have found shorter methods for studying many phases of the question of plant nutrition. But the spirit of thoroughness and the perseverance which led to the continuation of a single experiment through forty or fifty years are well worthy of emulation. It is only by adhering to a definite policy for a number of years that an agricultural experiment station can expect to work out problems of importance so that the results will have a permanent value. The importance of this element of permanency in station work can hardly be overestimated, and too frequently it seems not to be appreciated by those in charge of the work. It is not that the Rothamsted experiments are works of unusual genius, but that they have been carried out with that close attention to details and that persistency of effort which are so essential in all work of this nature. A knowledge of the methods pursued has inspired a widespread confidence in the Rothamsted work hardly bestowed upon any similar set of experiments. The results secured have become a part of our agricultural science, and have been incorporated into text-books the world over.

"By far the greater part of the laboratory investigations, whether chemical or botanical, have had for their object the solution of problems suggested by the field and feeding results." The work in the field and stable was constantly supplemented by that in the chemical and botanical laboratories; and it was by attacking questions from different sides that results of such permanent value were attained. Thus, in field experiments not merely the growing of crops with different fertilizers and determining the yield was undertaken, but the soil and the drainage waters were studied, the meteorological conditions were observed, and the composition of the crops was determined. In one series of experiments more than seven hundred ash analyses were made of the crops, which is believed to be "the finest series of ash analyses yet executed and the most instructive, the results exhibiting the influence upon the composition of the ash of wide differences both in the supply of mineral food and in the character of the season." Again, in connection with a series of experiments with fertilizers on meadows, botanical analyses of the herbage on the experimental plats have been made systematically since 1857. In feeding experiments with growing animals, not only the food eaten and the gain in weight were recorded, but animals were slaughtered at different stages of growth or fatness, and analyses, including those of the ash, made of the carcasses.

The united efforts of the station have thus been concentrated upon one or two lines of work at a time. The permanent work has been the experiments with fertilizers for different field crops grown continuously and in rotation. The investigation of special subjects, largely suggested by these experiments, has been taken up from time to time. At one time we find questions of animal nutrition and the composition of the increase in fattening animals occupying a part of the attention, at another time studies of the rain and drainage waters, and again the soil, nitrification, etc. But the field experiments have gone on without interruption and have remained a prominent feature of the station's operations.

Recent visits to a considerable number of experiment stations in this country have confirmed the impression that in too many cases the stations are scattering their efforts on a variety of comparatively unimportant investigations. There is need of much greater concentration of work and of more efficient coöperation among the different workers in the planning and carrying out of important lines of work. In many cases it would be far better for the station to select some line of investigation suggested by its environment and make this the central feature of its work, grouping other inquiries about this in such a way that they might contribute to the securing of the most productive results along this line. In some cases the organization of the station seems to stand in the way of proper coöperation. Each department is so far independent that it not only determines its own line of work, but even considers that it is doing a favor to other departments if it aids in their investigations. This is obviously a bad arrangement. It is the duty of boards of control to see to it that the organization of the station shall be such as will facilitate the carrying out of thorough investigations on some well-considered plan. Unity in organization and work is absolutely essential to the successful conduct of an experiment station.

Not of the least importance in the eyes of those in charge of the Rothamsted work is the keeping of detailed records of every experiment or investigation undertaken. For this purpose and for tabulating and computing the data ample clerical force is provided. Lately this has included three clerks; and an effort is made to keep duplicate copies of the tabulations in different places to avoid the risk of loss by fire. Care is taken, furthermore, to preserve samples of the soils, crops, and feeding stuffs, and the ashes of crops and animals, so that at any future time the results obtained can be verified, or studied from a new point of view suggested by the progress of science. In several instances this has already been done. Any new hypothesis advanced can be tested by the records and samples collected at Rothamsted. These remain a mine of information for the agriculturist and are the starting point for many an investigation.

The importance of systematic records and of sufficient clerical force to keep them properly is too frequently unappreciated by our stations. The pocket notebook kept by the person in charge of the experiment as a temporary record until the results are published frequently constitutes the only record the station has of the experiment. Such a method of record keeping seems to be wholly inexcusable. It is unscientific, and it provides the station with no satisfactory record of its work. The published account should not be relied upon for the permanent record. Many of the data incident to an experiment may be omitted from publications of the nature of station bulletins and reports. But these data should be kept in proper form so that they will be available for a reconsideration of the results at any time, or for comparison with other experiments that may be made. In a number of instances in which additional data of feeding experiments have been requested for comparison, the reply has been that the station had no permanent record of the experiments except that published in the bulletin. Reference to the bulletin showed only general summaries and averages, with no statement of the quality or composition of the feeding stuffs used, the amounts of food fed daily, or the details of the gains or losses in weight of the animals fed. It was in fact only a meager account of the conditions and results of the experiment. As far as permanent value is concerned these experiments might as well not have been made, and the time and money expended on them might better have been used in completing and putting into permanent form the records of other experiments.

The Rothamsted experiments teach many lessons, but they teach no more important one for the American stations than that of permanent persistent effort along a few special lines, with the exercise of all the precautions suggested by scientific investigation, and the keeping of detailed records of the conditions and results of the work. A few experiments carefully planned and supervised, with full permanent records, carry more conviction and are of greater benefit to both the practice and science of agriculture than any number of carelessly conducted, incomplete trials with fragmentary records.

THE PRINCIPLES AND METHODS OF BREEDING CULTIVATED

PROF. G. LIEBSCHER,
Director of the Agricultural Institute at Gottingen, Germany.

The subject of plant breeding, which is occupying the attention of many scientists at the present time, is by no means a new one. The ancients, through the selection of the more useful and the rejection of the less valuable of the plants surrounding them, established such a successful system of plant breeding that in later times the number of cultivated plants has increased but little. The early Roman farmers sought to improve their cereals by the careful selection of seed. It has long been known that the best seed must be sown to secure the largest harvest, but it has only been a comparatively few years since the full value of improving plants by breeding has been understood. Only within the last decade have the methods by which the florist secures new and valuable plants been applied to the improvement of field and garden crops. English, French, and German breeders like Hallet, Vilmorin, Rimpau, and others, have sought new and more productive varieties of grain through artificial methods. Knauer, Dippe, Vilmorin, and especially Rabbethge have striven to produce a more profitable sugar beet. In order to prevent potato disease and to secure larger returns from the fields, American, English, and German breeders, especially Richter, of Zwickau, have sought to produce new varieties that should be more productive and less susceptible to disease than those in common use.

The methods of the different plant breeders necessarily differ with the kind of plants employed and must closely follow the method of reproduction of the different plants. Of fundamental importance is the certainty with which parental characteristics are impressed upon the progeny, and next is the variability of the progeny. This can be readily observed in the phenomena of heredity shown in any group of culture plants.

I.—BREEDING POTATOES.

The potato can be produced asexually by planting tubers or sexually by means of seed. The tubers are simply thickened portions of the underground stem of the mother plant and are formed without the influence of any other individual. It therefore follows that tubers produced from other tubers will possess the same characteristics as the mother plant, and it is rare that any variation occurs in them. Plants

produced from tubers are nothing more than parts of the mother plant, separated by artificial means into numerous individuals and growing in different places. These plants will resemble the mother in all inherited characteristics, although, on account of varying conditions of plant food, soil, and climate they may develop some traits not possessed by the mother. When such individuals are found they are called "tuber variations." These rarely occur, since it is almost impossible to change the inherited characteristics of the potato through selection of tubers. On account of the greater amount of nourishment present plants grown from large tubers may have an earlier and stronger growth, and this, together with favorable conditions of soil and climate, may have a special influence on the size of the tubers, but the inherited qualities of the potato will be left unchanged. If the breeder wishes to influence the inherited characteristics of the tuber he must induce variation through the seed. Each of the hundreds of seed in the seed boll of the potato is formed by the mingling of the male and female elements. Each seed contains a separate combination of the characteristics of each of the parents. Among the hundreds of new combinations of characteristics exhibited by the plants grown from the seed in a single seed boll a few may be expected to equal the mother plant in agricultural value, but most of the new sorts will prove less valuable. Among these new combinations an occasional individual may exhibit characteristics of higher value than those possessed by the mother. The more valuable the parents the greater is the possibility of securing good offspring. The more dissimilar the parents the more numerous will be the new forms resulting from sexual propagation, but the more nearly alike they are the larger will be the proportion of the offspring having a harmonious blending of the parental characteristics. It may be confidently asserted as a fundamental law that varieties resulting from sexual reproduction may not only be traced back to new combinations of parental characteristics, but the individual resulting from such a union of elements lacks fixedness in its new characteristics and is especially inclined to sport, and that hybrids from it are predisposed to such variation. Experience has shown that the tendency of sexual reproduction to sport is stronger when the parents are most dissimilar.

The aim in potato breeding is to produce new varieties which excel in productiveness, power of resistance to disease, and frequently in earliness. Besides these it is often important to consider the percentage of starch, the color, form, taste, and the depth of the eyes. Before the breeder attempts to improve any one of the characteristics of his variety he should choose for crossing with it the kind which will give the desired qualities. Since but few of the better new varieties produce pollen, it is important to have a number of varieties producing potent pollen, some of which possess at least one or two of the desired good qualities, and whose other characteristics are not objectionable.

Having secured the male plant, a variety that is most similar to it must be chosen to be fertilized in order to secure a new variety having one or two good qualities not possessed by the parents. If this object is attained in any of the progeny then the new and better sort may in turn be fertilized with the pollen of a male similar to it but in some respect its superior. From the progeny of these parents the best will be selected until the breeder thinks he has secured a new variety of potatoes that so far excels the old ones as to be worthy of introduction into the markets.

The artificial fertilization is easily accomplished in the following manner: The stamens are removed with a pair of pinchers from the flower to be fertilized, and the stigma sprinkled for several successive days with the pollen from the other plant. This pollen may be secured from a mature flower by knocking it upon the finger nail or into a watch glass and can be sprinkled upon the stigma or applied by means of a camel's hair brush. The flowers thus treated should be inclosed in a paper bag, the mouth of which is stopped with cotton. To the bag and also to the peduncle labels should be fastened giving the date of the fertilization and the variety from which the pollen was taken. After a few days either the flower falls off in the case of unsuccessful fertilization or the seed boll swells into a berry, when the paper bag may be removed, but the label should be allowed to remain on the stem, and all other seed bolls removed from the plant to avoid any possible confusion. When the berry has matured it should be placed in a plainly labeled receptacle until the seeds are separated by macerating the seed boll in water. Early in the spring the seeds are sown in a flat seed dish and sprouted in a hotbed. When the young plants have formed their first leaves they are "picked out," and at the beginning of warm weather they are transplanted to a well-manured and well-prepared garden bed, being set out 60 by 60 cm. apart, and well cultivated during the season. In this way it is possible to secure the first year plants which will produce tubers weighing 1 kg. each. Those plants which are evidently inferior to the others are rejected, and the tubers produced by the apparently superior plants are saved for planting the next year, when the value of the new variety may be more accurately determined. It must be borne in mind that the tubers of the seedling plants of the first generation are the progenitors of new varieties and that those produced by each tuber have their own peculiar combination of characteristics though they may greatly resemble one another. It is therefore imperatively necessary that the product of each seedling be harvested separately, well labeled, and kept apart from the others. It is not usual to make an examination of the starch content of the product of the seedling, but this is ordinarily postponed until the larger harvest of the second year.

In the spring well-developed specimens of seedling tubers are planted 1 meter apart each way in the field in well-manured ground. During

the growing season the earth must be hilled up, working it between the branches which are spread out into a circular form. The large space given the plants is desirable in order that they may attain their maximum development without crowding. By closer planting a fair representation of the capabilities of a variety from the 5 or 10 plants of each kind planted can not be secured. Naturally the tubers of each variety should be kept together in planting and a plan should be devised so that at any time the varieties may be recognized. It is a common practice to surround each plat with a row of corn. As the experimental field of a professional potato breeder will contain from 100 to 1,000 varieties of plants, each of whose capabilities for bearing and other qualities are to be compared, the greatest care must be exercised in planning and laying out the experimental field. At harvest records should be made regarding each variety, noting pedigree, number of plants, number and weight of the harvested tubers, and other data, such as the appearance of the tubers, flowers, leaves, etc.

Those sorts which are seen by comparison to be inferior in respect to yield or resistance to disease should be rejected, and in this the breeder can not be too liberal, since it is desirable to subject to further test only such as have particular merit.

The whole crop of each of the remaining varieties or at least an average sample weighing several kilograms should be put away in a well-ventilated cellar, each sort in a bin to itself. Each variety should be tested for starch, using the Reimann potato scales, the Sohmann apparatus, or the brine test. So far as appears necessary the eating qualities should be tested and recorded. The results thus obtained will indicate a large number that should be rejected on account of their inferior qualities. The next spring 10 well developed tubers of the remaining sorts should be planted and the methods of the previous year repeated. After several years' tests certain varieties will be indicated which are deemed worthy of several years' trial under ordinary field culture in order that it may be fully determined which varieties are adapted to the trade or which ones could have some of their characteristics further improved by new crosses. Further fixing by the breeder of acquired characteristics is unnecessary; by the asexual methods already described nature will perpetuate the variety.

II.—BREEDING OF SUGAR BEETS.

The conditions which the sugar beet breeder must contend with are quite different from those of the potato breeder. The sugar beet is always reproduced in a sexual manner, and the wind often carries the pollen for the fertilization of the flowers to great distances. This cross pollination produces, as we have already seen in the potato, a constant tendency of the progeny to vary, and this fact makes the breeding of sugar beets especially difficult. While the potato breeder has to do with a plant which voluntarily varies but little and a consid-

erable portion of his attention is given to securing material subject to variation, the beet grower on the other hand must restrain the tendency to variation and if possible suppress it for two or three generations.

The course to be followed in the improvement of sugar beets is suggested by what has already been said concerning potatoes, namely, the selection of parental stock with valuable and marked characteristics and very similar in external appearances. These are planted together far from other beets, that they may fertilize each other, or the mother beet may be so divided as to secure several plants, whose flowers will fertilize each other, thus securing a minimum of variation. In spite of all such precautions variation will be observed and varieties will deteriorate unless the greatest care be taken to prevent it, by always selecting the most conspicuous individuals as the mother plants for the continued propagation of the variety. This is just the reverse of potato production, for when a potato breeder has developed a new variety and got it into the trade he is unable to further artificially improve it, and every farmer can enjoy its productiveness until it finally deteriorates and becomes worthless.

In selecting beets in the field for improvement it should be borne in mind that usually those beets which possess numerous strong curled leaves that lie flat upon the ground in the form of a rosette, which do not shoot up to seed and whose crown does not extend above the surface of the ground, excel in sugar content those having strong erect petioles and thick, spreading leaves. From the beets thus selected there must be rejected those whose roots are forked or too slender or too blunt or too fibrous. Those specimens which are chosen by the breeder on account of their leaf and root excellencies are, after the removal of only the larger leaves, carried from the field and arranged in shallow furrows, the beets standing erect in separate rows. If it is not possible to continue the testing at this time they are at first covered with a thin layer of dry earth and at the approach of winter are more deeply covered to prevent freezing.

In testing beets a section about the size of a lead pencil is taken from each root just below the neck and its specific gravity tested in brine, it being well known that beets having the greatest specific gravity have the highest sugar content. In this way at least 90 per cent of the beets are rejected, leaving 10 per cent or less to be subjected to further tests. When the beets have been improved to a high degree of excellence this crude method will not prove adequate and is dispensed with. A second grouping of the beets is made according to weight, those varying 50 gm. being placed in separate classes. In this the beets are dried and cleaned by brushing and then automatically weighed. This operation should be done in the fall, if possible, in order that beets of approximately the same weight be stored together.

The main reliance in beet selection must be placed on the polariscope test of the sugar content of each individual. By means of a special device a cylindrical core about 20 mm. in diameter is bored out in the shape of a fine pulp 2 or 3 cm. below the neck of the beet. A portion of this pulp is clarified with lead acetate and polarized. As beets of but one group are tested at a time the ascertained sugar content is considered the measure of their relative worth. In every hundred beets tested, 2 or 3 are taken as the "best beets," the others are put away until planting time, when they are used for seed production in the so-called "sprout breeding" (*Stecklingszucht*). Provided with the boring machines and polariscopes 10 skilled men in a day of 10 hours can test from 600 to 700 beets, and 1 chemist can superintend and control from 6 to 10 such groups of men. The chemist should make occasional polarizations, comparing his results with those secured by the workers, and also convince himself that no mistake has been made in the choice of the 2 or 3 "best" beets. The selected "best" beets are labeled with the results of the test and taken to a second laboratory, where further tests are made which furnish the basis for a still finer classification.

In the classification of sugar beets it is necessary to consider the weight of the beet as well as its sugar content. In fact it is often possible to calculate how much the sugar content will decrease with every increase of 50 gm. in weight of the beet. If it is found that there is a decrease of 0.2 per cent for every increase of 50 gm. in weight and that the minimum sugar content of a "best" beet weighing 500 gm. is 16 per cent, then a beet weighing 750 gm. and having a sugar content of 15 per cent, would belong to the same class and would be placed in the lowest group, which is designated as Class 0. A beet weighing 750 gm. with a sugar content of 16 per cent would be 5 points higher and would be placed in Class 5, etc. Tables have been constructed on this basis so that from the weight and polarization of each beet its value can readily be determined. After classifying according to the tables the beets are put away in rows in incinerated sand in the cellar until planting time.

In the spring the beets are planted separately according to their grouping, and the breeder seeks to protect the high class beets from injury by surrounding and covering them with wire netting. The different plats are surrounded by rows of hops or kidney beans and as a further precaution against undesirable fertilization the different varieties are planted as far apart as possible. It is also advisable as a further protection to plant portions of each variety in different plats at some distance apart to prevent the complete destruction by hailstorms, etc. Such storms usually travel in belts so that while some plats may be destroyed others will escape.

In order to secure the largest quantity of seed many breeders cut the beets into halves or quarters and plant the pieces 1 meter or more apart

in well-manured soil. From a whole beet about 1 pound of seed may be secured, if cut in halves from 1 to 2 pounds, and in quarters from 2 to 3 pounds.

The seed from the "best" beets are in field culture usually drilled by hand as a matter of economy of seed. By fall they will furnish a new crop for a selection for continued improvement.

The beets which have not been selected for further development are used as seed producers for the market. The demand will determine how low in the scale of classes of the previous year's beets the breeder shall go in selecting his mother beets. The seed from the lower classes of beets are closely drilled in rows 20 cm. apart and about 8 to 10 cm. in the row in order to produce a large number of seedlings to supply the next season's demand for beet seed. From the first sowing of the "best" beet seed until the appearance in the market of the improved variety at least 4 years should elapse, which time is occupied by the breeder in continued growing and selecting of the "best" beets. In order to select 300 of the "best" beets from two or three millions, much work and capital are necessarily spent each year. It is reasonable that breeders who conduct their business in this scientific manner should receive a higher price for their improved seed than the individual who grows seed under ordinary conditions for the market.

In the practice of beet breeding, as may be readily seen from the foregoing, the technique of selection has been developed with extraordinary care, but until lately almost no distinction was drawn between beets which owe their good qualities to culture conditions, which they are unable to transmit, and those that owe these qualities to heredity and are able to transmit them to their progeny. Hence it followed that no attention was given to the cultivation of individual beets, but rather to groups having apparently the same value. This method of breeding doubtless unites individuals of different breeding value into the same group, for every group consists of plants which under *varying* conditions of growth possess the *same* characteristics and which under *like* conditions show *different* characteristics. From the breeder's standpoint these are of different values, but it is nearly impossible to distinguish the better from the poorer. Manuring, for example, may make a change of several per cent in the sugar content of a beet. In the field culture of millions of beets which an energetic beet breeder yearly investigates in order to select a few hundred of the best, it is quite unavoidable that some should be grown under different conditions of plant food, water, soil, temperature, external injury, light, etc. It is equally evident that beets which on account of heredity should possess absolute equality of characteristics must under such conditions show differences in weight, and consequently in their sugar content, while on the other hand beets possessing the same weight and sugar content may have a different breeding value. If then such great differences in quality can occur in beets of the same breeding value, it would seem

that we have gone too far in adopting a classification based upon a few tenths per cent differences in sugar content. The results of Knauer's investigations showed that beets from the seed of the same conspicuously improved mother beet gave a difference of more than 5 per cent in sugar content. Within such limits a method exacting a difference of but 0.2 per cent variation would seem to unnecessarily increase the work of the breeder.

So long as we were unable to determine how much of the desirable quality of a beet must be accredited to conditions of growth and how much to heredity, very slow progress could be made in improvement, because it was necessary to select the best individuals through a long series of years in order to lessen the proportion of those whose good qualities were due to external accident. In order to modify this unfavorable circumstance, experiments were carried on for about 30 years in Kleinwanzleben in which a number of different breedings of the same variety were separately undertaken in order to distinguish those crosses which, on account of the mixture of inferior qualities, were very slowly or not at all improved. To this method of breeding is due the Kleinwanzleben, a variety held in high esteem throughout the world. Nevertheless this method is considered crude as compared with the selection of individuals which are to be the progenitors of new varieties; that is, the breeding of families in every case represents a decided advance. In this practice of breeding of beet families such improvement has been made within the past few years as to promise a revolution in the subject. Novoczeck has succeeded in dividing a single beet into from 50 to 200 individual plants through the drawing of sprouts. These being planted together obviates the possibility of fertilization from a less valuable individual and thereby permits the formation of a large family which represents the product of a single beet. When the mother beet has been well chosen, the breeder has a stock which must possess a greater certainty of inheriting the good characteristics of the mother than has been heretofore possible. The work of the beet breeder of the future on this account will become more circumscribed, and it will be possible for anyone to carry on beet improvement where he is now deterred on account of the lack of funds.

The method of conducting the so-called asexual breeding of Novoczeck is as follows: The most highly improved beets selected are set out in a hotbed or hothouse and after beginning to sprout the sprouts are cut away, together with a small lenticular portion of the beet body. These asexual seedlings are left to wilt over night, when they are planted in a seed pan and covered with glass. If not kept too damp they will soon begin to root and when they have put out 2 or 3 leaves they should be set out in the hotbed, and later, when danger from frost is passed, they are transplanted into a well manured field. If the eyes are removed from the mother plant when too young or before

they have put out their shoots their growth will be so checked that although growing good-sized beets they will produce no seed when set out 30 by 30 cm. apart. If care has been taken that the seedlings of each mother plant be planted in single rows in similar soil, in autumn each individual of the progeny or family can be examined for its sugar content. In each row will be found beets very similar in sugar content, and those rows the mother beet of which owed its excellent qualities to accidental peculiarities will be easily distinguished. By following this practice only about 10 of the best beets will need to be examined instead of 200 or 300 under the old system. If we have the product of 10 beets and reject those of 3 on account of inferiorities we shall still have 7 families of about 100 plants each, and the succeeding year these will produce 2 or 3 times as many seed-bearing beets as if we had chosen 200 to 300 "best" beets by the other plan. With from one-twentieth to one-thirtieth of the labor formerly required, and in a year's less time, we can now secure double the number of seed possible under the old method, and besides have the certainty that through asexual propagation they have come from such individuals as are capable of transmitting their superior characteristics to their progeny. With the introduction of the methods of Novoczeck it is to be expected that a new era of rapid progress in beet improvement will begin, but as yet this method has not been sufficiently tested in practice to warrant its unconditional acceptance instead of the methods now in use.

It is a problem for the future to develop a system of asexual grafting whereby seed may be secured within one year. Since it is not yet definitely known whether the stock influences the graft, and if so, in what manner, the subject of the improvement of beets through grafting will not be entered into.

III.—THE BREEDING OF CEREALS.

The relations existing between reproduction and heredity which are the bases of all breeding efforts are different in grain from those in potatoes and beets. All cereals reproduce themselves by means of sexual fertilization. Some, like the maize and rye, are cross fertilized by pollen carried by the wind from one flower to another, while others, like wheat, barley, and oats, are subject to close fertilization, that is, the oösphere is fertilized by pollen from the anthers of the same flower. From this it follows that the tendency to variation is stronger in maize and rye and that the varieties are more difficult to maintain than is the case with the other cereals. At the first glance this view would seem to be contradicted in that rye has fewer well marked varieties than wheat or oats, but anyone who will carefully compare a number of individuals of a single variety of rye and of wheat will find the rye plants so variable in their characteristics that it will be difficult to decide which have the majority of the varietal traits, while on the other hand it will be

difficult to find individual wheat plants that do not possess all the varietal characteristics. When by artificial or accidental cross fertilization variation has been induced, it is easily possible to separate 50 or 100 new varieties from the progeny of a single seed. When these varieties are once well fixed by further reproduction through close fertilization but little variation will be found, or, what amounts to the same, the variety will possess a high degree of constancy in its inherited characteristics. This fact serves to account for the large number of varieties of wheat. The variations of rye are difficult to fix, because the peculiarities of each plant will be modified through cross fertilization.

The ever-present tendency to variation renders the cereals adaptable in a high degree to the natural-growth conditions of their habitat. Thus the varieties of wheat from the dry prairie regions of the United States when cultivated in the dry portions of eastern Germany have proved very good, although the prairie regions of the United States have in general a better soil than that of the dry, sandy districts of eastern Germany. The natural fertility of the soil increases the viability of the American wheat, while the dryness of the climate induces the ability to grow with a small amount of water. The American varieties of wheat are, therefore, as available for eastern Germany as the native sorts, and often excel them in growth. Another example is shown in the cereals from the still drier steppes of Russia. These are characterized by their early maturity, ability to grow with but little moisture, and above all, by their winter hardiness; but these characteristics are thus strongly developed at the expense of growth and reproductiveness. This same fact explains how the climate and soil conditions of Brandenburg and the district of Probstei in Holstein have developed varieties of rye which through their wonderful development of grain are celebrated throughout the world. It also explains why the varieties of wheat most noted for size of grain come from the fertile sunny portions of the Atlantic side of France, and that the varieties of wheat having the longest growing period, greatest viability and productiveness, but also making the highest demands on moisture of soil and climate, and also upon the fertility of the soil, always come from England. The immense stretch of territory in which maize culture can be conducted (the cultivation of maize extends entirely around the world, reaching on either side of the equator well into the temperate zones) has led to a very great number of varieties which possess different times of blooming and different periods of growth, so that they can be cultivated in juxtaposition and still each retain all its varietal characteristics. The size of the corn belt has developed numerous local varieties which can not be attributed to cross fertilization, while the narrow limits of the rye belt have hindered the formation of well-marked local varieties.

If the breeder desires to improve rye or maize he must first reduce their tendency to variation by careful selection of the best individual

plants and the isolated culture of their progeny as well as the rejection from the breeding plat of all plants showing any tendency to reversion. On the other hand, the breeder of wheat, barley, and oats must seek to induce variation in his breeding material by artificial cross fertilization, and from the numerous new varieties select the most valuable, or he must seek for accidental or the so-called spontaneous variations. He must also seek plants as far as possible adapted to his soil and climate, which having been produced by accidental cross fertilization retain their acquired characteristics. When he has found one that surpasses his other varieties in productiveness or some other good quality he should continue the breeding of the variety, taking especial pains to keep it pure. He must always remember that even the most constant varieties are subject to a small degree of variation, and that he must continually select individual plants for the continuation of his breeding. Besides this he must know that success can only be secured by directing his efforts to the improvement of varieties adapted to the climate and soil of his locality. For instance, it would be unwise to attempt to produce a cereal having notably a large grain requiring a long growing period in a region noted for its long and severe winters and its short, hot, dry summers. Experience has shown that such a climate will tend to decrease the size of the grain and shorten the growing period of the plant. So, too, it would prove a useless task for a breeder working in a mild climate and rich soil to produce a variety noted for its short growing period and its ability to withstand winter.

From the above we can see that the object of the cereal breeder should be either to produce new varieties or to so improve old ones that they are able to produce a maximum yield under the climatic and soil conditions possessed by the breeding place. The maximum yield can not be secured unless the necessary plant food and mechanical conditions of the soil are provided and unless the favorable conditions are not interfered with by weeds, etc. Strains of cereals will develop their superior characteristics only where they find careful manuring, cultivation, and attention.

Turning now to the technique of cereal breeding, we can lay down as a fundamental rule that every farmer who would accomplish anything as a cereal breeder must, in the cultivation of his fields and the culture of his crops, practice model farming. He must inform himself through years of careful experimentation so as to recognize and use those varieties which are distinguished for their productivity or other good qualities. Such experiments are not only of value to the breeder by providing the basis for further experimentation, but they serve as object lessons to the neighboring farmers, and they should be undertaken by as great a number of farmers as possible, all working upon a prearranged plan. Experiments of this character have been carried on under the direction of the author for the past 7 years upon hundreds of farms of members of the German Agricultural Society. Numerous

participants in such investigations are desirable because naturally the errors incidental to field investigations should be neutralized as much as possible. For the detailed regulations under which these experiments have been carried on the reader is referred to the publications of the author in the *Jahrbuch der Deutschen Landwirtschafts Gesellschaft.*

When a desirable variety has been found it is the duty of the breeder to take every precaution to keep it free from mixture. When placed upon the market the buyer of the seed is in position to decide upon the merits of the new variety, as he has but to look over his field when it is in bloom in order to see whether the seed has been kept from mixtures.

To secure and maintain the purity of the high-bred seed demands extraordinary care. It can be best accomplished in the following way: During the harvest a large number of good, typical heads are selected by workmen who have been previously instructed in the exact appearance of the variety desired, the amount thus collected depending upon circumstances. These heads should be threshed by themselves and the grain sown upon a field which has not been manured with stable manure for a year or more, since such manure is likely to contain viable seed of different cereals. The grain from this field must also be protected from mixing. The wagons in which the grain is hauled must be thoroughly cleaned, and the sheaves of grain must be stored apart from any other variety. The threshing machine, one of the chief sources of mixture, must be well cleaned and for 15 minutes summer grain should be run through it if the new sort is a winter grain, and *vice versa*. By this means it will be reasonably certain that the machine will be cleaned of all material that will cause injurious mixtures. The mixing of summer and winter grains is unimportant since the summer grain will be killed by the winter's cold if sown in the fall, and if sown in the spring the winter sorts will not mature their seed. After threshing the first lot of grain the machine should be run empty for about 15 minutes in order to clear it of all grain, and when another lot is threshed the first 50 lbs. should be rejected. The sacks, bins, and all utensils with which the grain comes in contact should be very carefully cleaned of all grain of other varieties. Even with all these precautions it is extremely difficult to keep strains pure when a large number are grown on the same farm. It is much simpler and more practicable for the grain breeder to confine his efforts to a single summer variety and a single winter variety. In this way much of the costly work required to keep the variety pure will be avoided.

Another line in which the efforts of the breeder may be profitably directed is the improvement of varieties already established. One of the simplest ways in which this can be done is by the selection of the heaviest, or what amounts to the same, the largest individual grains. In order to do this a sorting machine is required in which the grain is separated according to the shortest diameter of the seed, and under some circumstances sorting machines are used to separate seed accord-

ing to their length. In the grading of oats several other machines are used which separate the seed according to their specific gravity. The use of the heaviest seed is a rule of the greatest importance. It is based on the facts that (1) the largest seed more perfectly nourishes the plant and thereby aids the plant at the period when it is most liable to injury from insects, fungi, and unfavorable soil conditions, and (2) the plant springing from a large seed will produce a large seed yield; that is, there will be relatively a large proportion of grain and a small one of straw.

Another practice in the improving of cereals is in the choice of the largest heads. This may be done by grading them with the eye, but it is better to weigh them out into classes. As the size of the head is an acquired characteristic, seed selected in this way will produce a crop whose average size of heads will be increased. However, this method of selection seems to reduce the strength of the straw and gives the appearance of requiring a longer growing season, as if the growth of straw was increased to a greater degree than the grain production. Following this method of selection may result in the degeneration of a variety if attention is not given to the size of the grain as well as that of the head.

The development of a variety will be more certainly secured if the breeder will begin with a single plant which is preëminent in all its characteristics than by giving exclusive attention to the size of the grain or the head. In this work there are many difficulties to be overcome. It requires a well arranged breeding garden in which the individual plants are separated by at least 25 by 30 cm., a still greater distance being required for maize. This distance is necessary in order that each plant may fully exhibit its possibilities of growth, that the breeder will have space to examine each individual plant, that the neighboring plants may influence one another as little as possible, and that the growing period may be lengthened.

The breeding garden is best arranged as follows: The winter varieties are transplanted in the fall from the seed bed to the experimental garden. Of the summer varieties at least two seed are planted in each place, and in case more than one grows the other is pulled up. All vacancies arising from the destruction of plants are to be filled in with other sorts of grain. If rye or maize is being improved, all plants which do not appear up to the required standard must be removed before blooming. In any kind of grain breeding the most superior plant should be sought out at maturity. In doing this reference will be had to the total weight of the plant, and with this idea they must be gathered singly, bound together, and carefully dried. After drying, the plants are assorted according to weight, and those rejected which show many small, late-formed heads. After this the heads are cut off in order to ascertain the relative weight of heads and straw, and naturally those are preferred which have the highest proportion of heads. The same test will show the average weight of the heads, and those having

the highest average should be chosen. In connection with this investigation, the thickness of the spikelets on the ear stalk, the length of the internodes, and the strength of the nodes should be noted. A loose arrangement of the spikelets, a considerable strength of the nodes, together with short internodes below and long ones above, may be considered characteristics of a good variety. In the improvement of oats the selection of a panicle with as many series of branches as possible plays a prominent rôle, as such plants are characterized by vigorous growth and grain production. The value of the above mentioned characteristics has not yet been fully established, and it is possible that with barley a compact head is to be preferred. In selecting the best plants from the breeding garden in this manner, the breeder must remember that some of their superiority may be due to growth conditions. For this reason the Hallet plan of selecting only one plant and from this choosing the best head is not to be considered, since experiments by the author have shown that in many cases the most superior plants owed their excellence to accidental conditions, and possessed low hereditary power. It will be found much more satisfactory to choose at least 10 of the best plants, and from each of these take at least 5 heads from which all the normally developed seed are sown in the garden in such a manner that the acquired characteristics of each of the 10 plants may be tested. After the rejection of the undesirable families the breeding of those remaining is continued in such a way that a choice is annually made of the best plants for culture in the breeding garden, while the product of the larger number is sown in the field for market. The breeder in connection with this briefly outlined plan should also give attention to other characteristics, such as resistance to frost and mildew, late maturity, etc.

In addition to the above described methods of procedure for improving grains, the breeder must use his own judgment as to the variation which is due to accidental cross fertilization or to other means. In this way he can by artificial cross fertilization produce new forms whose characteristics can be improved and fixed through long periods of breeding. While it is true that many valuable varieties of cereals have been produced through artificial cross pollination, still this work is so extremely tedious and narrow in view of the results offered that in general it can be considered as only a side issue to be followed by breeders.

More success is likely to follow the search for spontaneous variations. Plants are often noticed which vary in some particular from the characteristics of their varieties. These the breeder should spare no pains to gather and develop in the breeding plats, for thus opportunity may be offered for the development of varieties that may be very superior in some of their characteristics. In this way most of our best varieties of grain have been produced and we know nothing more of their origin than that their progenitors were found by some farmer in his grain

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The Kjeldahl method for the determination of nitrogen, B. DYER (*Jour. Chem. Soc.. 1895, Aug., pp. 811–817, fig. 1; and Chem. News, 71 (1895), No. 1851. pp. 277, 278*).—The modification of this method, which the author found the best adapted to the analysis of feeding stuffs and fertilizers free from nitrates, is that of Gunning with the addition of mercury. He found "it best to allow the steam charged with ammonia to pass directly into the acid contained in a flask standing in a tank of running water, using as a means of communication between the distilling flask and the receiving flask a block-tin tube bent in the form of an arch. This rose perpendicularly from the cork of the distilling flask to a height of 15 or 18 in. before turning over." With this arrangement no soda was carried over with the steam.

"The Kjeldahl Gunning method was found to give very nearly the exact percentages of nitrogen in uric acid, asparagin, caffein, indigotin, morphin, quinin, strychnin, anilin, atropin, diphenylamin, naphthylamin, acetanilid, orthobenzoic sulphinid, sulphamido-benzoic acid, pyridin, benzidin, aldehyde ammonia, and nitroso di methylanilin."

The Jodlbauer method of modification was found best adapted to nitrates and nitro compounds. In using this method, however, it was found to be "highly important that the sulphuric acid containing the phenol or salicylic acid should be poured directly and suddenly on the material contained in the flask, so as to submerge it immediately and not to let it trickle from a pipette. If nitrates and ammonium salts are both present, loss of nitrogen occurs unless this precaution is observed; this does not appear to be generally known, and probably often gives rise to errors. . . . The Jodlbauer modification referred to by the author as the 'Kjeldahl-Gunning-Jodlbauer' method was found to give nearly correct percentages of nitrogen in potassium nitrate, ammonium nitrate, urea nitrate, nitrobenzene, nitronaphthalene, nitranalin, dinitrobenzene, trinitrophenol, and potassium para-bromo-chlor-nitrophenol."

In the tests of numerous other types of nitrogenous organic compounds the results were very variable, indicating that special treatment was required in most cases, while in others accurate results could probably not be obtained under any conditions.

On the fixation of atmospheric nitrogen and the preparation of cyanids and ammonia, F. WYATT (*Engineering and Mining Jour., 60 (1895), p. 123; abs. in Chem. Ztg., 19 (1895), No. 80, Repert., p. 282*).—The history of attempts to prepare cyanids and ammonia from atmospheric nitrogen is briefly reviewed, and the Fogarty process (patented) is discussed. This process may be briefly stated as follows: Nascent carbon derived from the continual heating of acetylene or similar compounds is brought into contact with nitrogen in the presence of an alkali and the three combine to form an alkaline cyanid. On subjecting the cyanid to the action of steam in a moderately heated chamber it breaks up and ammonium and carbonic acid are formed.

On the reducing substances contained in the sugar cane, M. DU BEAUFRET (*Bul. Assn. Chim. Sucr. Dist., 13 (1895), No. 2, pp. 133-138*).—The paper contains additional proof that the reducing substances in cane juice have no rotatory power, are non-fermentable, are not glucose, and give no alcohol on distillation. In the presence of alkaline earths they act like acids and form soluble and insoluble compounds with barium hydrate.—W. H. KRUG.

The estimation of reducing sugars by means of alkaline copper solution, F. GAND (*Compt. Rend., 119 (1894), p. 650; abs. in Ztschr. analyt. Chem., 34 (1895), No. 5, pp. 628-630*).—The author has calculated the error caused by the action of the excess of alkali in the copper solution. He proposes to eliminate this error by substituting ammonia, which has no action on sugars at 100°, for the fixed alkali. The reduction is made at 80° and is complete when the solution becomes colorless.—W. H. KRUG.

The preparation of citric acid from sucrose, T. L. PHIPSON (*Chem. News, 72 (1895), p. 100; abs. in Chem. Ztg., 19 (1895), No. 76, Repert., p. 271*).—The author finds that the acids in fruit decrease proportionately as the sugars increase. By treating sucrose with the requisite amount of potassium permanganate solution he obtained a small quantity of a calcium salt which he supposes to be calcium citrate.—W. H. KRUG.

Detection of alum in wine, GEORGES (*Jour. Pharm. et Chim., ser. 6, 2 (1895), No. 1, pp. 22-26*).—Twenty cubic centimeters of red wine is treated with 2 cc. of a solution of 3.4 gm. tannin in 100 cc. and then with 4 cc. of a solution of 24 gm. of crystallized sodium acetate in 100 cc. and the whole mixed by shaking. If a distinct precipitate is formed within 5 minutes it may be assumed that alum has been added to the wine. If the liquid remains clear or is only slightly turbid after 5 minutes, alum is not present.

If it is desired to determine the percentage of alumina as a control, 500 cc. of wine is treated with 1 gm. of pure tannin dissolved in water, and then with a solution containing 25 gm. of neutral sodium acetate, and the precipitate washed, ignited, and weighed. It then only remains to determine the alumina by any satisfactory method for its determination in the presence of iron.—W. D. BIGELOW.

Determination of tannin in wine, A. VIGNA (*Staz. Sper. Agr. Ital., 28 (1895), pp. 19–22; abs. in Chem. Centbl., 1895, II, No. 7, p. 420*).—The author states that by using potassium alum in place of zinc acetate time may be saved, and the troublesome warming on the water bath avoided. Fifty cubic centimeters of the wine is treated with 40 cc. of an 80 per cent solution of potassium alum, and exactly neutralized with ammonia. The resulting precipitate is collected on a filter, washed with cold water, returned to the beaker in which the precipitation was made, and titrated in the ordinary manner with potassium permanganate after the addition of indigo solution. The method is said by the author to give accurate results.—W. D. BIGELOW.

Determination of glycerol and mannite in wine, G. MANCUSO-LIMA and G. SCARLATA (*Staz. Sper. Agr. Ital., 28 (1895), No. 4, pp. 236–245; abs. in Chem. Centbl., 1895, II, No. 7, p. 420*).—The method is said to be rapid and inexpensive. It is based on the fact that lead hydrate, freshly precipitated with an excess of ammonia, precipitates glucose and mannite completely, and that the filtrate from that precipitate, after removing the lead by means of sodium carbonate and acidifying with sulphuric acid, does not reduce potassium permanganate.

(1) Twenty-five cubic centimeters of wine is evaporated on the water bath to a sirupy consistence and treated with lead hydrate which has been freshly prepared by precipitation with an excess of ammonia. The mixture is filtered in an atmosphere free from carbon dioxid, an inverted funnel, whose stem is connected with a potash tube, being carefully placed over the funnel in which the filtration takes place. The filtrate is treated with an excess of concentrated sulphuric acid, filtered, and the filtrate titrated with a normal solution of potassium permanganate. The number of cubic centimeters of potassium permanganate solution required for the oxidation multiplied by 0.1 gives the weight of glycerol in 25 cubic cc. of wine.

(2) Fifty cubic centimeters of wine is evaporated on the water bath to a sirupy consistence, the residue treated with basic lead acetate, and filtered. The filtrate is made up to 500 cc. and the sugar determined in one-half of the solution by titration with Fehling's solution after removing the lead with sodium carbonate. The weight of dextrose found, divided by 0.0081, gives the number of cubic centimeters of normal potassium permanganate required to oxidize the dextrose contained in 25 cc. of wine. The other half of the filtrate from the precipitate formed with basic lead acetate is treated with an excess of sulphuric acid, filtered, and the filtrate titrated with a normal solution of potassium permanganate. The number of cubic centimeters of permanganate used, less the number required for the oxidation of the glycerol (1) and the number corresponding to the amount of dextrose present, multiplied by 0.0089, gives the weight of mannite in 25 cc. of wine.—W. D. BIGELOW.

Convention of the Association of German Naturalists and Physicians, Lübeck, September 16-21, 1895 (*Chem. Ztg., 19* (*1895*), *Nos. 58, pp. 1333, 1334; 76, pp. 1703-1707; 77, pp. 1728-1732; 78, pp. 1754-1763*).

Report of the agricultural chemical experiment station at Halle for 1894, M. MÄRCKER (*Ztschr. landw. Cent. Ver. Sachsen, 1895, No. 2, pp. 52-62*).

Quantitative chemical analysis, F. CLOWES and J. B. COLEMAN (*London: J. and A. Churchill, 3d ed., 1895, pp. 534*).

A laboratory manual of organic chemistry, LASSAR-COHN (*Translated into English by A. Smith. London and New York: Macmillan & Co., 1895, pp. 403*).

Studies on the thermo chemistry of nitrogenous organic compounds, BERTHELOT (*Ann. Chim. et Phys., 1895, Oct., pp. 232-296*).

Action of oxid of nitrogen on metals and on mercuric oxids, P. SABATIER and J. B. SENDERENS (*Bul. Soc. Chim. Paris, 13-14* (*1895*), *No. 18-19, pp. 870-873*).

Starch, H. M. WARD (*Nature, 52* (*1895*), *No. 1357, pp. 640, 641*).—A review is given of A. Meyer's work entitled "*Untersuchungen uber die Stärkekörner.*"

Investigations on the action of spittle, pancreas, intestinal fluid, and blood on starch paste, C. HAMBURGER (*Pflüger's Arch. Physiol., 60, No. 11 and 12, pp. 543-577*).

On the presence of a sulphur compound in cotton-seed oil, J. DUPONT (*Bul. Soc. Chim. Paris, 13-14* (*1895*), *No. 13, pp. 696, 697*).

On the composition of some fruit and berry wines, A. PETERMANN (*Bul. Sta. Agron. Gembloux, 1895, Sept.: abs. in Chem. Ztg., 19* (*1895*), *No. 81, Repert., p. 307*).

The determination of argon, T. SCHLOESSING (*Compt. Rend., 121* (*1895*), *No. 16, pp. 525-528, fig. 1*)

On the determination of boron, H. MOISSAN (*Ann. Chim. et Phys., 1895, Nov., pp. 428-432, fig. 1*).

The determination of minute quantities of copper in organic substances, K. B. LEHMANN (*Arch. Hyg., 24, No. 1, pp. 1-17*).

A method for the quantitative determination of ammonia derived from nicotin in tobacco, V. VEDRÖDI (*Ztschr. analyt. Chem., 34* (*1895*), *No. 4, pp. 413-420*).

Determination of citrate-soluble phosphoric acid in Thomas slag, P. WAGNER (*Chem. Ztg., 19* (*1895*), *No. 63, pp. 1419-1421, fig. 1*).—The method here described is essentially the same as that given in *Chem. Ztg., 18* (*1894*), *No. 98, p. 1933* (E. S. R., 6, p. 625), no account being taken of the basicity of the slag.

Determination of phosphoric acid with the aid of a centrifuge, H. VON JÜPTNER (*Oesterr. Ztschr. Berg. Huttenwesens, 43* (*1895*), *p. 403; abs. in Chem. Ztg., 19* (*1895*), *No. 84, Repert., p. 305*).

On the chemical investigation of vegetable oils and butter, P. LEVIN (*Chem. Ztg., 19* (*1895*), *No. 81, pp. 1832, 1833*).

Weighing the copper obtained in the gravimetric determination of sugars as oxid, K. FARNSTEINER (*Neue Ztschr. Rubenz. Ind., 35* (*1895*), *No. 11, pp. 111-114*).—The copper is oxidized to cupric oxid by gently heating it in a current of air and is then weighed as such.—W. H. KRUG.

Volemit, a new heptit, E. FISCHER (*Neue Ztschr. Rubenz. Ind., 35* (*1895*), *No. 12, pp. 125-126; Ber. deut. chem. Ges., 28* (*1895*), *p. 1973*).—The mushroom *Lactarius volemus* contains a crystalline substance which Bourquelot called volemit. It is a heptit, and when oxidized yields a sugar, volemose. The formula of volemit is $C_7H_{16}O_7$, the corrected melting point 151-153°, $[a]_D^{20°} = +1.92$ in 10 per cent aqueous solution.—W. H. KRUG.

A new balance for determining the specific gravity of the juice of mother beets, K. KOMERS (*Oesterr. ungar. Ztschr. Zuckerind. und Landw., 24, pp. 492-496; Wien. chem. techn. Vers. Sta. des Cent. Ver. Rubenz. Ind.; abs. in Chem. Centbl., 1895, II, No 9, p. 510*).

The clarification of sugar solutions with tannic acid before polarization, A. STIFT and E. PETZIVAL (*Oesterr. ungar. Ztschr. Zuckerind. und Landw., 1895, p. 480; abs. in Ztschr. angew. Chem., 1895, No. 18, p. 551; Analyst, 20* (*1895*), *No. 235, p. 232*).—

The authors point out several objections to the use of tannin or lead acetate. They strongly advise the employment of Herle's plan, which consists in the use of lead nitrate and works well even with dark liquids.—W. H. KRUG.

The diastatic decomposition of starch, H. MITTELMEIER (*Mitt. oesterr. Vers. Brauer.; abs. in Ztschr. angew. Chem., 1895, No. 18. p. 552*).—The paper describes 2 new dextrins which are designated as secondary erythro- and achroo-dextrin, respectively.—W. H. KRUG.

On the influence of the presence of lead acetates on the results obtained with the Fehling-Soxhlet method for invert sugar, A. BORNTRAGER (*Ztschr. angew. Chem., 1895, No. 20, p. 594*).—The presence of lead acetate lowers the results and it is necessary to remove it with sodium phosphate before making the titration. Sodium phosphate is better than sodium sulphate, as it removes the lead completely, which the latter does not accomplish.—W. H. KRUG.

Molecular modifications of glucose, C. TANRET (*Compt. Rend., 120 (1895), pp. 1060–1062; abs. in Jour. Chem Soc., 1895, Oct., p. 190*). - Three forms are distinguished, α, β, and γ, glucose differing in rotatory power and solubilities.—W. H. KRUG.

The determination of sugars by copper-potassium carbonate solution, H. OST (*Chem. Ztg., 19 (1895), Nos. 79, pp. 1784, 1787; 81, pp. 1829, 1830*).—Reduction tables obtained with this solution are given for dextrose, levulose, invert sugar, and maltose.—W. H. KRUG.

A diastatic ferment in the sugar beet, M. GONNERMANN (*Chem. Ztg., 19 (1895), No. 80, p. 1806*).—The sugar beet contains an enzym which converts amylo-dextrin into dextrose. In the beet this enzym probably forms sucrose from the starch.—W. H. KRUG.

The glucosazones from sumach and valonea, C. BOETTINGER (*Arch. Pharm., 233 (1895), pp. 125–127; abs. in Jour. Chem. Soc., 1895, Oct., p. 40*).—These osazones are identical and agree with the osazone obtained from grape sugar.—W. H. KRUG.

On a sugar high in carbon derived from galactose, E. FISCHER (*Ann. Chem., 288 (1895), No. 2, pp. 139–157*).

A new method for preparing glycerose, FONZES DIACON (*Bul. Soc. Chim. Paris, ser. 3, 13–14 (1895), p. 862; abs. in Chem. Ztg., 19 (1895), No 80, Repert., p. 277*).

The non-nitrogenous organic non-sugars, W. MAXWELL (*Deut. Zuckerind., 19 (1895), p. 1188; abs. in Chem. Ztg., 19 (1895), No. 80, Repert., p. 279*).

Analyses of the ash of sugar canes, VAN LOOKEREN-CAMPAGNE and VAN DER VEEN (*Deut. Zuckerind., 19 (1895), p. 1188; abs. in Chem. Ztg., 19 (1895), No. 80, Repert., p. 279*).

On the formation of citric acid by the oxidation of cane sugar, E. F. HICKS (*Chem. News, 72 (1895), p 165*).—The work of T. L. Phipson is reviewed and the precipitate which the latter thought to be calcium citrate is shown to be hydrated calcium sulphate.—W. H. KRUG.

Citric and tartaric acids from cane sugar, T. L. PHIPSON (*Chem. News, 72 (1895), p. 190*).—An answer to the criticism of Hicks, detailing an experiment with the use of nitric acid, which resulted in the formation of citric and tartaric acids.—W. H. KRUG.

Compounds of the sugars with alcohols and ketones, E. FISCHER (*Ber. deut. chem. Ges., 28 (1895) pp. 1145–1167; abs. in Jour. Chem. Soc., 1895, Sept., p. 437*).

Idose, idit, idonic acid, and idosaccharic acid, E. FISCHER and I. W. FAY (*Neue Ztschr. Rübenz. Ind., 35 (1895), No. 13, p. 133; Ber. deut. chem. Ges., 28 (1895), p. 1975*).

Constitution of glucosids and glucoses, L. MARSCHLEWSKI (*Ber. deut. chem. Ges., 28 (1895), pp. 1622, 1623; abs. in Jour. Chem. Soc., 1895, Oct., p. 490*).

Inversion of sucrose and raffinose, E. BESEMFELDER (*Neue Ztschr. Rübenz. Ind., 35 (1895), No. 15, p. 156*).—A new commercial process based on the inverting action of aluminum sulphate.—W. H. KRUG.

The inversion of sucrose by bacteria, C. FERMI and G. MONTESANO (*Centbl. Bakt. und Par. Allg., 1 (1895), pp. 482–487, 542–556; abs. in Chem. Centbl., 1895, II, No. 16, p. 712*).

Discrimination between lactose and glucose in adulterated peptones, L. RUIZARD (*Jour. Pharm. et Chim., ser. 6, 1 (1895), pp. 232, 233; abs. in Jour. Chem. Soc., 1895, Oct., p. 424*).

Resolution of starch by the action of oxalic acid, C. J. LINTNER and G. DÜLL (*Ber. deut. chem. Ges., 28 (1895), p. 1522; abs. in Jour. Chem. Soc., 1895, Oct., p. 491*).

The rotatory power of maltose, H. OST (*Neue Ztschr. Rübenz. Ind., 35 (1895), No. 13, p. 129*).

The microscopy of honey, R. PFISTER (*Forsch. Lebensmtl. Hyg. Chem., 2 (1895), p. 1; abs. in Ztschr. analyt. Chem., 34 (1895), No. 4, p. 479*).

The official control of the sale of honey in Germany, E. UTESCHER (*Apoth. Ztg., 10 (1895), p. 196*).

Extraction apparatus for sugar, fat, tannin, and similar substances, A. STEIN (*Chem. Ztg., 19 (1895), No. 81, p. 1833*)

On a new extraction apparatus, J. J. L. VAN RIJN (*Ber. deut. chem. Ges., 28 [1895, No. 15], p. 2387, fig. 1*).—An apparatus for the continuous extraction of liquids with ether or a similar solvent at its boiling temperature.—A. M. PETER.

The determination of tannin by metallic oxids, W. H. KRUG (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 811–814*).—The tannins present in tanning extracts combine with various metallic oxids when the diluted extract is shaken with them. In the case of the yellow mercuric oxid this reaction is very uniform and therefore yields comparable results.—W. H. KRUG.

The influence of different temperatures on the extraction of tanning substances, J. G. PARKER and H. R. PROCTER (*Jour. Soc. Chem. Ind., 14 (1895), p. 635; abs. in Chem. Centbl., 1895, II, No. 11, p. 578*).—Most tanning materials are easily extracted at 60–70°. Extraction with cold water causes a loss of about 35 per cent of the tanning substances.—W. H. KRUG.

The extraction of tannic acid from tanning materials, H. TRIMBLE and J. C. PEACOCK (*Jour. Amer. Chem. Soc., 17 (1895), p. 514; abs. in Bul. Soc. Chim. Paris, ser. 3, 12, p. 399; Ztsch. analyt. Chem., 34 (1895), No. 4, p. 467*).

Potassium tetraoxalate for standardizing solutions (*Ztschr. analyt. Chem., 34 (1895), No. 4, pp. 431, 432*).

Miscellaneous analyses, D. ADRIANCE, P. S. TILSON, and H. H. HARRINGTON (*Texas Sta. Bul. 35, pp. 601–605*).—Results are reported of examinations of 18 samples of clay, 3 of marl, 5 of bat guano and bat guano ash, 6 of crude petroleum, 2 of cactus fruit, and 1 each of cactus plant, iron ore, and natural gas.

BOTANY.

The physiological rôle of water in plants, E. GAIN (*Ann. sci. nat. Bot., ser. 7, 20 (1895), Nos. 1–6, pp. 63–215, pls. 4*).—The work of various authors is reviewed as to the physiological function of water in plants. Without stating the morphological and chemical changes induced by varying quantities of water, the author discusses the results of his experiments under 3 heads, (1) influence of water upon increase in weight, (2) influence on actual growth, (3) influence upon the propagation and improvement of the species.

The experiments were conducted with pot and open-plat cultivations, so that the limit of error should be as small as possible. The pot experiments, which were the principal ones, were subjected to identical conditions, and, so far as possible, seed of the same weight were used, as it is well known that large seed in general give large plants. In plat experiments where large numbers of seed were used it was impos-

sible to select the seed in every case, and to provide against this error the author removed from each plat all specimens above or below the average in development, leaving only those which were comparable.

The first lot of experiments was conducted during a period of remarkable drought, the dry soils containing about 3 to 6 per cent of their weight in water, while the moist soils were watered every sixth day for an hour and contained from 12 to 16 per cent water. In a previous paper[1] the author has given some of the effects of soil moisture on vegetation, and in the present article the following questions are considered: (1) Is there an optimum of humidity varying according to the plant under consideration and the stage of its vegetation? (2) What is the relation between the absolute value of the optimum and the climatic conditions of the region where a given species is found? (3) Within what limits is excessive moisture of the soil able to influence the water content of the different parts of the plant? (4) What will be the effect upon the increase of weight and upon total growth of growing plants of the same species in soils having a totally different water content? (5) Does the optimum for the individual also represent the optimum for the maximum growth for the species?

Concerning the influence of water upon the increase in weight, the author states that there is an optimum humidity of the soil that varies for the various plant organs and also for the different stages of their growth. Increase in dry weight is checked by too much water as well as by too little.

The general conclusions of the author are: (1) The root is especially influenced by the water content of soil. Under the influence of drought there is a great weakening of the root after flowering, the period of growth is considerably shortened, and the vitality of the entire plant is soon affected. (2) The cotyledons continue to grow much longer in a moist soil than in a dry one. The per cent of dry weight of the cotyledons as compared with their fresh weight is greater for those plants which were grown in dry soil. (3) The influence of humidity is first shown upon the development of the hypocotyl, afterwards upon the epicotyl. (4) This action favors in a general way the development of the plant, increasing its fresh weight to a much greater degree than its dry weight, but this influence is exerted to a greater degree upon the aërial than upon the subterranean parts of the plant. As a result of this influence, of 2 stems of the same weight the root of the one growing in dry soil will be developed to the greater extent. (5) The maximum of the fresh and dry weight of plant organs varies according to the water content of the soil. (6) The proportion of water in plants is greater in a humid atmosphere, but the difference is slight when the periods of growth are considered.

Under the head of "Influence of water on actual growth," the author states that when a seed has become swollen the quantity of water

[1] Rev. gén. Bot., 7 (1895), Nos. 73, 74, and 75 (E. S. R., 6, p. 869).

required for its germination is quite small, 15 per cent of soil saturation being sufficient. A saturated soil will secure the rapid swelling of the seed, but the germination will be greatly checked. A water content of 25 to 30 per cent of saturation will usually be found to give the best germination results. A dry soil, that is, one containing just enough water to swell the seed and provide for evaporation, will usually give a germination equal to the best, but the subsequent growth of the plants will be impaired. Investigations with various soils showed that the conditions for germination vary with the kinds of soil.

When the roots have been fixed in the soil and while the first leaves are being formed there should be an increased humidity of the soil, an optimum requiring 40 to 45 per cent of saturation, in order to secure (1) a regular development in the weight of the root and its growth in general, and (2) the normal development of the stem and leaves in quickly securing the minimum per cent of dry weight without injury to the growth of the root. If sufficient water is not available at this time the stem draws upon the root, and as it is not able to supply the demand, its further growth is greatly impaired. After this critical period is passed the amount of water in the soil should be decreased, or the leaf formation will proceed too rapidly, resulting in a partial chlorosis. At this time a water content of 25 per cent of saturation is sufficient for optimum results.

A little before flowering there is a rapid rise in the curves of weight. At this time there should be a percentage of humidity of soil amounting to 40 to 50 per cent of saturation. Immediately after flowering there should be a sudden diminution of the amount of water, about 15 per cent of saturation being sufficient. For many plants a second branching and flowering is desirable. For these there should be a second rise in the water content of the soil, after which there should be a reduction to about 10 per cent of saturation. The curves of growth show that a continued drought, in which the water content is reduced to 10 per cent, or a permanent humidity amounting to 40 to 60 per cent, will seriously interfere with physiological activity of the plant. During the period of greatest leaf formation the water content should fall to about 20 or 25 per cent of saturation. If the water content of the soil should rise to about 45 per cent, growth will be greatly accelerated and the period of flowering hastened. After flowering, a water content of 10 per cent will be found most beneficial for fruit and seed production.

By tracing the curves of optimum growth there is found to be a sort of alternation in the amount of water required by plants, indicating the optimum moisture conditions to be adopted under a system of irrigation.

In conclusion the author states that it is impossible to consider average conditions as applicable to all plants, but that generalizations must be made with due consideration to the peculiarities of each species of plant.

Under the head of "The influence of water upon the reproduction and future welfare of the species," the author gives his observations upon the reproduction by means of seed and cuttings. The effect of drought or lack of sufficient water is considered in its effect (1) upon the seed, (2) upon the plant, and (3) upon the reproduction of the plant, *i. e.*, seed, tubers, etc. The effect of an inadequate amount of water upon germination is well known. Some kinds of seed rapidly depreciate in viability when kept too dry. This applies to seed either in the ground or not, and will account to some degree for the lack of vitality shown by old seed. While some seed are able to lie dormant in the ground for some time and may grow the following year, the rule is that their vitality decreases with their increased age.

The action of a spring drought following the conditions of an ordinary year is given. Early germinating seed will not be influenced by such conditions to the extent that those germinating late in the spring or summer will suffer. The effect of drought upon the young plantlet is the same for the individual and species, and through a lack of nutrition many plants perish. The author found a severe drought fatal to bean, poppy, and campanula seedlings, while the injury was less severely felt by such seedlings as wheat, barley, rye, corn, hemp, etc. Relative to the reproduction of the species, two points are considered—influence on number of seed and influence upon the quality of the seed. The number of seed will depend upon the number of inflorescences, number of flowers per inflorescence, number of ovules fecundated, number of matured fruits, and number of seed per fruit. Of these conditions, the first two are dependent upon moisture conditions previous to flowering, the third is hardly dependent directly upon soil conditions, the others are concerned with the later periods of the plant's life. In all these it is shown that humid conditions favor and augment the number of fruits and seed produced, drought greatly reducing the number of inflorescences as well as the number of seed in each fruit, although the proportion varies with different plants. On the other hand, it appears that the individual seed produced by plants grown in dry soil will be larger and heavier than those grown in moist soil. It was found that plants grown under the same conditions were larger and heavier from seed grown in dry soil conditions than in moist ones. The author also states that there is a greater tendency to variation, and especially to degeneration, among the numerous small seed produced in moist soil.

In view of its practical application the author has formulated the following law: "Humidity of soil favors and increases to a considerable degree the production of fruit and seed. Irrigation is therefore recommended when the product is for industrial purposes. On the contrary, irrigation should be used with care when the crop is to be employed for seed. To irrigate brood grain is to subject it to degeneration and the production of small seed. Drought, on the contrary, is very favorable for the maintenance of the species."

The effect of drought upon the production of tubers and other methods of asexual reproduction is stated as follows: "The number of tubers formed will be but little influenced by the water content of the soil. In a humid soil the plant tends to produce larger tubers and a greater total product in weight. The polarity of the tubers grown in moist soil will be less marked as though their physiological differentiation had been checked. The tubers are therefore less perfect than those grown in dry soil." The author concludes that under certain conditions the maximum growth of the individual is antagonistic to the continuance and perfection of the race.

The experiments of the author which were conducted at the Biological Laboratory of Fontainbleau embraced the following plants: Lupines, lentils, beans, peas, sainfoin, alfalfa, wheat, barley, rye, oats, corn, buckwheat, flax, hemp, 5 varieties of potatoes, tomatoes, rape, stramonium, sunflower, artichoke, radish, gourd, castor bean, poppy, tobacco, shepherd's purse, horse mint, campanula, larkspur, evening primrose, peppergrass, water hemlock, madder, wormwood, etc.

The time of trehalose formation in plants, E. E. BOURQUELOT (*Bul. Soc. Mycol. France, 9, p. 11; abs. in Jour. Chem. Soc., 1895, Sept., p. 362*).—In species of fungi whose development proceeds uninterruptedly, trehalose is formed appreciably only during spore formation. Those species which at times form a sclerotium behave variably, some acting like those already mentioned while in others the sclerotium develops trehalose even during the period of stagnation. The trehalose is formed from a reserve substance, probably a carbohydrate analogous to dextrin.—W. H. KRUG.

Flora of the sand hills of Nebraska, P. A. RYDBERG (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 3, No. 3, pp. 133–203, pls. 3*).—The author gives a list, with critical notes, of the species of plants collected during the summer of 1893 in what is known as the sand hill region of western Nebraska. Notes are also given of the region, its topography, climatic conditions, and the industries of agriculture and stock raising as there practiced.

Botany at the British Association (*Nature, 52 (1895), No. 1354, pp. 584–586*).—A brief account is given of the botanical papers presented at the recent meeting of the British Association.

The botanical work of J. Vesque, E. C. BERTRAND (*Ann. Agron., 21 (1895), No. 10, pp. 473–489*).

Elements of plant anatomy, E. L. GREGORY (*Boston: Ginn & Co., pp. VIII and 148*).

British fungus flora—a classified text book of mycology, IV, G. MASSEE (*London. Geo. Bell & Sons, 1895, pp. VIII and 522*).

Handbook of grasses, W. HUTCHINSON (*New York: Macmillan & Co., 1895, pp. 92*).

Synopsis of North American Amarantaceæ, E. B. ULINE and W. L. BRAY (*Bot. Gaz., 20 (1895), No. 10, pp. 449–453*).—A revision of the genus Alteranthera is given.

Mississippi fungi, S. M. TRACY and F. S. EARLE (*Mississippi Sta. Bul. 34, pp. 80–122*).—A list, with critical notes, is given of the fungi collected from time to time by the authors. It embraces 113 genera and 350 species, 55 of which have proved to be new ones.

New species of fungi, J. B. ELLIS and B. M. EVERHART (*Torrey Bul., 22 (1895), No. 10, pp. 434–440*).—Descriptions are given of new species of fungi from the Sandwich Islands, Florida, and Mexico.

New or peculiar aquatic fungi, R. THAXTER (*Bot. Gaz., 20 (1895), Nos. 10, pp. 433–440, pls. 2; 11, pp. 477–485*).

A review of the works on fungi published during 1891–'93, J. COSTANTIN (*Rev. gén. Bot., 6 (1894), Nos. 69, pp. 370–378; 70, pp. 411–423; 71, pp. 460–470; 7 (1895), Nos. 73, pp. 45–48; 74, pp. 94–96; 75, pp. 139–144; 76, pp. 177–192*).

Concerning Fusarium aquæductum and its relationship to some Ascomycetes, H. GLÜCK (*Hedwigia, 34 (1895), No. 5, pp. 254, 255*).

A simple method for making visible the pores of the spore membranes of rust fungi, DIETEL (*Ztschr. angew. Mikros., 1 (1895), No. 3, pp. 69–71*).

New or noteworthy grasses, G. V. NASH (*Torrey Bul., 22 (1895), No. 10, pp. 419–424*).—Descriptions and critical notes are given of various North American grasses. The author has perhaps improperly transferred the species of Setaria to Ixophorus.

A contribution to the study of the morpholgy and biology of Cladosporium and Dematium, A. N. BERLESE (*Riv. pat. Veg., 4 (1895), No. 1–6, pp. 3–45, pls. 6*).

On the structure, development, and perfect form of Gliocladium, L. MATRUCHOT (*Rev. gén. Bot., 7 (1895), No. 80, pp. 321–331, pl. 1*).

The distinction between animals and plants, J. C. ARTHUR (*Amer. Nat., 29 (1895), No. 347, pp. 961–965*).

On the essential similarity of the process of chrososome reduction in animals and plants, J. E. S. MOORE (*Ann. Bot., 9 (1895), No. 35, pp. 431–439*).

On the phenomena of reproduction in plants and animals, J. BEARD and J. A. MURRAY (*Ann. Bot., 9 (1895), No. 35, pp. 441–468, figs. 5*).

The sexual reproduction of the Basidiomycetes—a memoir, P. A. DANGEARD (*Le Botaniste, ser. 4, 1895, pp. 119–181*).

On the presence of sex organs in the Uredineæ, N. NYPELS (*Bul. Soc. Micr. Belge, 21 (1895), p. 70*).

Have the æcidia of the Uredineæ the ability of reproducing themselves? P. DIETEL (*Verhandl. Ges. deut. Naturf. und Aerzte, 66 (1894), p. 169; abs. in Hedwigia, 34 (1895), No. 3, Repert., p. 83*).

Deviation in development due to the use of unripe seed, J. C. ARTHUR (*Amer. Nat., 29 (1895), Nos. 345, pp. 804–815; 346, pp. 904–913*).—The author reviews the extensive literature relative to this subject and gives conclusions based upon his and others' experiments. The general conclusions have previously been given in the report of the botanist of Indiana Station, 1893 (E. S. R., 6, p. 378). A bibliography accompanies the present paper.

A note on buffalo grass, A. S. HITCHCOCK (*Bot. Gaz., 20 (1895), No. 10, p. 464*).—The author investigated the so-called diœcism of *Buchloe dactyloides* by planting in 1893 a single seedling. In 1895 the plant flowered, bearing both kinds of flowers, but not from the same node. The author was unable to determine whether they were borne on the same or independent stolons.

The origin of plant structures by self-adaptation to the environment, G. HENSLOW (*London: Paul, 1895, pp. 270*).

Concerning the anatomical and physiological investigation of tropical leaves, G. HABERLANDT (*Sitzungsber. kgl. Akad. wissensch. Math. natur. Classe Wein, 103 (1894), No. 6–7, pt. 1, pp. 489–538, pls. 3*).

Antidromy in plants, G. MACLOSKIE (*Amer. Nat., 29 (1895), No. 347, pp. 973–978, figs. 9; Torrey Bul., 22 (1895), No. 9, pp. 379–387*).

Investigations in geotropism, J. SACHS (*Flora, 80 (1895), No. 2, pp. 293–302; abs. in Bot. Centbl., 63 (1895), No. 12, p. 360*).

An experimental investigation of the geotropic curving of roots, M. WACHTEL (*Arb. St. Petersburg Naturf. Ges., 25 (1895), p. 17; abs. in Bot. Centbl., 63 (1895), No. 10-11, pp. 309, 310*).

Influence of light on the respiration of germinating barley and wheat, F. DAY (*Proc. and Trans. Edinburgh Bot. Soc., 20 (1894), pt. 1, pp. 185-213*).

The amount of transpiration of plants as a measure of their adaptability to cultivation, H. MÜLLER-THURGAU (*Weinbau und Weinhandl., 1893, No. 5-6; abs. in Centbl. agr. Chem., 24 (1895), No. 3, pp. 167-170*).

Concerning the transpiration of the potato, L. POLJANEC (*Oesterr. Bot. Ztschr., 45 (1895), No. 10, pp. 369-374*).

Kroeber's transpiration experiments, E. F. SMITH (*Amer. Nat., 29 (1895), No. 347, pp. 1010, 1011*).—A brief résumé is given of the experiments of Kroeber reported in *Landw. Jahrb., 24 (1895), No. 3, pp. 503-557*.

Leaf absorption, G. PAUL and W. B. HEMSLEY (*Nature, 52 (1895), No. 1354, pp. 569, 570*).—An example of absorption by the leaves of common privet is cited, together with a general explanation of the phenomenon.

On the division of the chromosomes in the pollen mother cells of lily, J. B. FARMER (*Jour. Roy. Micr. Soc., 1895, No. 5, pp. 501-504*).

The influence of spray and rain on the form of leaves, C. MACMILLAN (*Science, n. ser., 2 (1895), No. 41, pp. 181, 182*).—A review of several recent works on the influence of aqueous deposits on the form of leaves.

The regulatory growth of mechanical tissue, F. C. NEWCOMBE (*Bot. Gaz., 20 (1895), No. 10, pp. 441-448*).

A contribution to the morphology of grasses, K. GOEBEL (*Flora, 1895, pp. 13, pl. 1, figs. 11; abs. in Bot. Centbl., 64 (1895), No. 1, pp. 20-22*).

On the penetration of cell membranes by fungus mycelium, M. MIYOSHI (*Pringheim's Jahrb. wiss. Bot., 28 (1895), pp. 269-289, figs. 3*)

The penetration of roots into living tissues, R. BEER (*Nature, 52 (1895), No. 1356, pp. 630, 631*).

A new and remarkable case of symbiosis, P. A. DANGEARD (*Le Botaniste, ser. 4, 1895, pp. 182-187*).

Fixation of free nitrogen, SIR J. H. GILBERT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 22, pp. 110-115, figs. 5*).—The author reviews the work of himself and others on assimilation of free nitrogen by legumes, a summary of which has already been given (E. S. R., 3, p. 331).

Soil inoculation for papilionaceous plants in farm practice (*Die Boden-Impfung zu den Pflanzen mit Schmetterlingsbluten im landwirtschaftlichen Betriebe*), A. SALFELD (*Bremen: M. Heinsius Nachfolger, 1896, pp. 100, figs. 6, pls. 2*).

The non-assimilation of atmospheric nitrogen by germinating barley, F. DAY (*Proc. and. Trans. Edinburgh Bot. Soc., 20 (1894), pt. 1, pp. 29-34*).

The chemistry of chlorophyll, L. MARCHLEWSKI (*Die Chemie des Chlorophylls. Hamburg and Leipsic: 1895, pp. 82, figs. 2; abs. in Bot. Centbl., 63 (1895), No. 10-11, pp. 310-311*).

On the technique of cutting and handling paraffin embedded sections, G. C. VAN WALSEM (*Ztschr. wiss. Mikros., 11 (1895), pp. 207-236; abs. in Bot. Centbl., 63 (1895), No. 12, pp. 357-360*).

Concerning the spring flowering plants in the vicinity of Paris, E. ROZE (*Bul. Soc. Bot. France, 52 (1895), pp. 330, 331*).

METEOROLOGY.

Annual weather summary, 1894, J. G. LEE (*Louisiana Stas. Bul. 35, 2d ser., p. 1206*).—A tabulated summary of observations during each month at the North Louisiana Station on temperature, rainfall, etc.

The highest temperatures, 102°, was recorded on July 1; the lowest, 12°, on December 28. The mean temperature for the year was 64.7°; total rainfall, 55.46 in., and the number of rainy days 86.

Meteorological summary for 1893, N. HELME (*Rhode Island Sta. Rpt. 1893, pp. 311–316*).—A monthly summary of observations on temperature, pressure, precipitation, cloudiness, and direction of wind is given for 5 years (1890–'93). The summary for 1893 is as follows: *Temperature* (degrees F.).—Mean, 46.5; highest, 92, June 20; lowest, –6, January 11; annual range, 98; highest monthly mean, 69, July; lowest monthly mean. 19.2, January; highest daily mean, 77.5, July 18; lowest daily mean, 1.5, January 11. *Rainfall* (inches).—Total, 57.33; greatest monthly, 9.44, February; least monthly, 0.95, July. *Snowfall* (inches).—Total, 78; greatest monthly, 29, February; least monthly, 8, April. *Weather*.—Number of clear days, 126; number of fair days, 130; number of cloudy days, 109; number of days on which 0.01 inch or more of rain fell, 131.

Report on phenological investigations for 1895 (*Quart. Jour. Roy. Meteor. Soc., 21 (1895), No. 94; abs. in Bot. Centbl., 64 (1895), No. 1, pp. 23, 24*).

Phenological observations in Giessen, H. HOFFMANN (*Oberhess. Ges. Natur. Heilkunde, 30 (1895), pp. 81–102*).

Phenological observations, 1892, E. IHNE (*Oberhess. Ges. Natur. Heilkunde, 30 (1895), pp. 1–18*).

Phenological observations, 1893, E. IHNE (*Oberhess. Ges. Natur. Heilkunde, 30 (1895), pp. 63–80*).

The diurnal march of relative humidity, D. EGINITIS (*Compt. Rend., 121 (1895), No. 17, pp. 574, 575*).

Investigations concerning the relation of atmospheric precipitation to plants and soils, E. WOLLNY (*Forsch. Geb. agr. Phys., 18 (1895), No. 1–2, pp. 180–201*).

WATER—SOILS.

Concerning the transport of soluble salts by the movement of water in the soil, H. PUCHNER (*Forsch. Geb. agr. Phys., 18 (1895), No. 1 and 2, pp. 1–26*).—Experiments are reported with soils of known composition to which were added in different cases definite amounts (never exceeding 0.5 per cent of the soil) of sodium chlorid and potassium chlorid and a mixture of soluble salts. The soils were placed in galvanized iron cylinders 50 cm. deep and 5 cm. in diameter, and some of these were arranged so that water could rise by capillarity to the surface and others were subjected to percolation. The upper, middle, and lower portion of each cylinder was then sampled and analyzed. The soils used were quartz sand, loam, and rich humus soil.

The results indicate that, as a rule, the soluble salts rose and sunk with the soil water, but that the movement depended to some extent on the chemical and physical properties of the soil. The accumulation of salts at the surface increased with the rapidity of evaporation. Nevertheless there was a sudden and marked increase of these salts at the moment when the moisture reached the surface of the soil.

The rise and fall of soluble salts were slower in crumbly than in powdery soils.

The mineral matter taken up by the water appeared to be divided into two groups, those which follow the movement of the soil water, including the alkalis, magnesia, chlorin, sulphuric acid, nitric acid, and silicic acid, and those which are but slightly affected by the movement of the water, including aluminum, iron, manganese, and carbonic acid. Phosphoric acid also is but slightly affected by the movement of the soil water. Lime is peculiar in that it rises with the soil water but does not sink with it.

Temperatures and evaporation in different soils, D. J. CROSBY (*Michigan Sta. Bul. 125, pp. 30–32*).—Observations on these subjects were made in 1891, as follows:

"Four granite ironware dishes, each 2½ in. deep and holding about 2 qts., were filled with soil, 1 each of sand, clay, loam, and muck. These were placed in an evaporating oven kept at 212° F. until all the water had evaporated. To each dish was then added 16 oz. of water, which the earth absorbed, when the dishes were all placed in an exposed situation out of doors. A thermometer was placed in the soil of each, extending to the bottom of the dish. The reading of the thermometer and the weight of each sample of soil were taken daily except Sunday for a period of 9 days, from August 18 to 26, inclusive. At first the observations were taken hourly during the daytime, afterwards at longer intervals. The table below shows the per cent of the moisture which had evaporated from each kind of soil at successive periods of time, and its average temperature for the whole period:

Soil.	5 hours	10 hours.	20 hours	30 hours	50 hours	70 hours.	97 hours	147 hours.	197 hours.	Average temp.
Sand	25.8	35.9	40.6	75.0	84.4	90.6	Dry	.....	.....	87.6
Clay	25.8	34.4	38.3	71.9	82.0	87.5	93.7	96.9	99.2	88.7
Loam	28.1	36.7	40.6	69.5	74.2	78.1	85.1	89.0	91.4	90.8
Muck	22.6	25.8	26.5	37.5	41.4	45.3	54.2	59.4	62.5	92.1

"From the above it will be seen that the sand dried the most rapidly and the muck the slowest, while the average temperatures increased, in the reverse order, from the sand through the clay and loam to the muck, which was the warmest.

"The experiment was then varied by taking 4 boxes, 1 for each kind of earth, the boxes being each 1 ft. deep and 2 ft. square, with perforated bottoms. These were sunk in the open ground until their tops were level with the surface and then left several weeks to settle. Hourly observations then taken at the surface of the soil during the daytime for 2 successive days—August 18 and 19—gave the following average temperatures: Sand, 96.3°; clay, 96.4°; loam, 99.2°; muck, 102.4°, the order of temperatures thus being the same as before. Another set of readings, extending from August 4 to 17, inclusive, at 3 different depths, gave the following:

Soil	Average temperatures.		
Sand	92.6	86.5	80.3
Clay	93.0	86.7	81.6
Loam	94.6	86.3	79.8
Muck	96.9	84.5	77.0

"Here it appears that the relative temperatures at the surface do not necessarily hold for lower depths, for the muck, which was the warmest of the 4 soils at the surface, was at the depth of 6 in. the coldest. The question then arose, To what con-

dition or conditions of these soils were these differences in temperature due? The fact that the surface temperature increased from the light-colored sand through the clay and loam to the dark-colored muck suggested an examination first into the influence of color. One-half of the box of sand above mentioned was therefore covered with lampblack and half of the box of muck covered with lime. The temperatures of each half of each box at the surface and at depths of 3 and 6 in. were then taken for a period of 6 days, with results which are summarized in the following table:

	Sand.		Muck	
	Black	Uncolored.	Uncolored	White.
	Deg	*Deg.*	*Deg.*	*Deg.*
Surface	86 8	83.7	91 7	82 2
3 inches	79 1	77 3	77 5	73 5
6 inches	70 0	69 5	64 7	63.4
Average	78 6	76.8	78.0	73.0

"These figures indicate that muck itself is not warmer than sand, but, on the contrary, that when sand is colored dark like muck it is the warmer of the two. In both cases it appears that the soil with the dark surface, whether natural or artificially colored, was warmer. It seems also from an inspection of the table that even at a depth of 6 in. an increased temperature was found under the darker surfaces. These observations were repeated with different soils and with thermometers placed at depths extending to 7 in., the highest temperatures being still found under the dark-colored surfaces."

Washington soils, E. FULMER and C. C. FLETCHER (*Washington Sta. Bul. 13, pp. 11*).—This is a report of progress in "an exhaustive soil survey of the State" begun some time ago, and includes a general discussion of the origin and composition of soils; explanations of terms used, and interpretation of results obtained in soil analyses; and notes and tabulated data for chemical analyses of 20 samples of soil sent to the station for examination, representing 3 sections of the State: (1) West of the Cascade Mountains, (2) the irrigated districts of eastern and central Washington, and (3) the Palouse region.

Analyses of 7 samples of soil from southeastern Washington by the Division of Chemistry of this Department are added for comparison.

The maximum, minimum, and average percentages of potash, phosphoric acid, lime, and nitrogen in soils from eastern Washington, where rainfall is deficient, and from western Washington, where the rainfall is more abundant, are shown in the following table:

Composition of soils of eastern and western Washington.

	Eastern			Western		
	Maximum	Minimum.	Average	Maximum	Minimum.	Average.
Potash (K_2O)	0 6351	0.0582	0.3943	0.6505	0.0126	0.2156
Phosphoric acid (P_2O_5)	0.3455	0 1007	0.1785	0 5438	0.0384	0.2730
Lime (CaO)	1.7580	0.9300	1.1793	0.7690	0.0828	0 3686
Nitrogen	0.7203	0.1096	0.2368	1.3466	0 1023	0.4625

"This shows the soils of western Washington to have a higher average per cent of phosphoric acid, but lower average of potash and lime, than those of eastern Washington. Hence the former will wear out sooner on the side of lime and potash,

"Results of a large number of analyses have shown almost conclusively that soils in a region of abundant rainfall contain less lime than those in arid regions; provided, of course, that neither are underlaid by or in the vicinity of limestone formations. This fact is well verified in case of our soils east and west of the Cascade Mountains; the average lime content of the former being 3 times that of the latter. This is specially significant in view of the fact that nearly all the soils of eastern Washington are derived directly from black basaltic rocks.

"With the samples analyzed so far it seems almost as if the lime percentages are inversely proportional to the amount of annual rainfall.

"For example we find the following relations:

Annual rainfall	Lime	Annual rainfall.	Lime.
	Per cent		*Per cent.*
About 8 inches	1.2127	24 inches	0.6550
	0.9790		0.7690
	1.7580	18 inches	0.3625
20 to 22 inches	1.0814		0.4315
	1.1800		0.1303
	0.7810	76 inches	0.1090
	0.9200		0.0828

"It will be interesting to note whether future analyses will reveal this same relation between the rainfall and the lime content of our soils.

"All of the Washington soils thus far analyzed, except one, are unusually high in phosphoric acid. It is easy to account for this fact in portions of the State where the soil has been derived from basaltic rocks, [but] we are not yet prepared to advance any theory to account for the very high proportions of phosphoric acid in the soils of western Washington. More data are needed from other analyses."

A special apparatus for bacteriological sampling of well waters, H. L. BOLLEY and M. FIELD (*Amer. Micr. Jour., 16 (1895), No. 10, pp. 289-292, pl. 1*).

Examination of water for sanitary and technic purposes, H. LEFFMAN (*Philadelphia: P. Blakiston Son & Co., 1895, 3d ed.*).

Rendering drinking water germ free by the addition of hypochlorite of lime, A. LODE (*Arch. Hyg., 24, No. 3-4, pp. 236-264*).—The author finds that water can be rendered germ free by the use of hypochlorite of lime, following a modification of the method of M. Traube.

Mineral waters, D. ADRIANCE, P. S. TILSON, and H. H. HARRINGTON (*Texas Sta. Bul. 35, pp. 595-599*).—Analyses with reference to mineral constituents of 22 samples of water are tabulated, with comments on the character of the different samples.

Rocks and soils, H. E. STOCKBRIDGE (*New York: John Wiley & Sons, 2d ed., 1895, pp. 282, figs. 22*).—The revision, the results of which are incorporated in this edition, consists of the correction of "errors incident to the conditions under which the publication was originally issued" and "a few changes of statement necessitated by the progress of the past seven years."

A chapter on "Use of the soil" has been added to the third part, in which "the familiar processes followed in crop production are discussed in their relations to the scientific facts on which rational soil cultivation rests." Several tables of composition of farm products, compiled from American sources, are included in the appendix.

In its revised form the value of the book is undoubtedly greatly increased, but it is believed that "rewriting and combining parts 1 and 2, and making them more specifically introductory to the subject-matter of part 3," as contemplated by the author, would still further increase its value as a treatise on soils. Such revision would give opportunity for fuller technical discussion in their appropriate connection of certain phases of soil physics now necessarily confined to the final chapter, and would permit the weeding out of some statements, such as that relating to the use of Nöbel's apparatus for mechanical soil analysis, which are clearly inaccurate.

The final chapter supplies in large measure the deficiencies of preceding chapters and enlarges the scope and usefulness of the work, but it advances views which are certain to be vigorously combated. This is especially true of statements in connection with the discussion of methods of determining the fertilizer requirements of soils and plants.

Those who have kept in touch with recent investigation in this line may be perfectly willing to admit the desirability of more thorough chemical study of the plant as an aid to the determination of the fertilizer requirements of the soil producing it, but they are not prepared to discard soil analysis or even field experiments, properly conducted, as worthless for this purpose.

Note on the behavior of hippuric acid in soils, K. YOSHIMURA (*College Agr. Univ. of Tokyo, Bul., vol. 2, No. 1, pp. 221-223*).

The influence of humus on the productiveness of soils, TANCRÉ (*Ztschr. landw. Cent. Ver. Sachsen, 1895, No. 9, pp. 329-333*).

Soils of Illinois, F. LEVERETT (*Ext. from Final Rpt. III, Bd. World's Fair Com., pp. 77-92, map 1*).—The areas of typical soils are mapped and their geological origin and physical character are discussed.

Soil moisture and fall plowing, G. H. FAILYER (*Industrialist, 21 (1895), No. 8, p. 30*).—A popular article.

Soils, D. ADRIANCE, P. S. TILSON, and H. H. HARRINGTON (*Texas Sta. Bul. 35, pp. 599-601*).—Chemical analyses of 11 samples are reported, with comments on the character of the different samples.

FERTILIZERS.

On the occasional ill effects of sulphate of ammonia as a manure and the use of air-slacked lime in overcoming the same, H. J. WHEELER and J. D. TOWAR (*Rhode Island Sta. Rpt. 1893, pp. 206-267, pls. 27*).

Synopsis.—Experiments during 3 years with sulphate of ammonia and nitrate of soda, each alone or combined with lime, on a great variety of field and garden crops grown on acid soil, showed that sulphate of ammonia used without air-slacked lime acted like a poison, and indicated that in all cases, except with lupines and soja beans, liming overcame the ill effect of the sulphate and rendered its nitrogen more available to the crop.

The results of previous investigations of the comparative fertilizing value of nitrogen in the form of nitrate of soda and sulphate of ammonia are briefly summarized and reasons for the conflicting character of these results are stated. Experiments of this character carried on during 3 years are reported in detail. Ill effects of an application of sulphate of ammonia were first observed on corn grown in 1890 on acid soil. In the following years it was shown "that lime was efficacious in overcoming the ill effect of the sulphate of ammonia and rendering its nitrogen available to the crop. . . . The sulphate of ammonia, when applied without air slacked lime, acted like a poison, the injurious effects increasing with the amount applied."

In 1893 experiments with sulphate of ammonia and nitrate of soda alone or combined with lime, were made with a great variety of crops, including corn, sorghum, oats, rye, barley, millet, buckwheat, red clover,

crimson clover, beans, peas, cowpeas, soja beans, lupines, beets, carrots, ruta-bagas, sunflowers, kale, cabbages, spinach, potatoes, tomatoes, and lettuce.

"The yields of the 38 miscellaneous crops show, without exception, where no air-slacked lime was used, that the sulphate of ammonia was inferior in its action to the nitrate of soda, and, in most cases, probably poisonous. On the other hand, where lime was applied in connection with the two forms of nitrogen, the ill effect of the sulphate of ammonia was not only overcome but in case of several crops the yield from the limed sulphate of ammonia plats even exceeded that where lime was used in connection with the nitrate of soda. With but few exceptions, the results show conclusively that the value of the lime was more due to its overcoming the natural acidity of the soil and the acid tendency of the sulphate of ammonia, whereby the nitrogen was changed into a form available to the plant, than to its direct fertilizing value.

"In the case of the lupine and soja bean, liming lowered the yield in connection with both forms of nitrogen. The reason for this effect remains to be ascertained. . . .

"These experiments show in the most conclusive manner that certain plants thrive best on the acid soil (for example, the lupine), while others, like the lettuce, beets, spinach, and sorghum refuse to produce a remunerative crop. . . .

"Among the cereals we find that barley was less able to withstand the acid-soil conditions than the oats and rye."

On the effect of air-slacked lime when used in connection with certain forms of organic nitrogen, H. J. WHEELER and J. D. TOWAR (*Rhode Island Sta. Rpt. 1893, pp. 267-272*).—The action of nitrate of soda, dried blood, and tankage, each alone or combined with air-slacked lime, was tested on acid soil with corn grown in pots and ruta-bagas grown in the field.

The results in the pots were unsatisfactory, but indicated a benefit from the use of lime in every case except where nitrate of soda was used. In the field experiment "the beneficial action of lime in connection with the nitrate of soda was extremely marked." In other respects the 2 experiments were practically in accord, both showing that the dried blood, which was neutral or slightly alkaline, produced better results than the tankage, which gave an acid reaction.

"The fact that the lime was of little or no benefit in connection with nitrate of soda in the pot experiment with Indian corn, furnishes very conclusive evidence of the fact that the latter was not seriously affected by the soil acidity, and consequently we are forced to the conclusion that the beneficial action of the lime in connection with the organic forms of nitrogen, as shown by the pot experiments, must have been due to its having aided in the transformation of their nitrogen into nitrates. The beneficial action of the lime in the same connection in the experiment with ruta-bagas is therefore doubtless attributable to two causes, viz, to its direct neutralizing action and to its having thereby aided nitrification."

Investigation of the Algerian phosphates; a phosphatic rock from Bougie having the composition of superphosphates, H. and A. MALBOT (*Compt. Rend., 121 (1895), No. 12, pp. 442-445*).—A number of analyses of phosphates from this source are reported. The external white part of the Bougie phosphate contained soluble phosphoric acid 13.29 per cent, reverted phosphoric acid 8.51 per cent, and insoluble phosphoric acid 11.7 per cent. The internal red portion con-

tained soluble phosphoric acid 2.03 per cent, reverted phosphoric acid 12.39 per cent, and no insoluble phosphoric acid. Comparative tests of methods on the different phosphates are reported which showed that the molybdic and citric acid methods gave concordant results, except in presence of organic matter which vitiated the results by the latter method. The results agreed closely when the organic matter was destroyed by calcination, and the error was reduced if the solution previous to precipitation was evaporated on the water bath with nitric acid.

Coöperative field experiments with fertilizers on corn, J. D. TOWAR (*Rhode Island Sta. Rpt. 1895, pp. 196–205, pls. 3*).—Experiments on 3 farms in continuation of those of previous years are reported. The plan of experiment was not altered except that on certain of the plats air slacked lime was applied at the rate of 2½ tons per acre.

The results indicate that phosphoric acid is the single element most needed.

As regards the form and amounts of nitrogen best adapted to corn "we find the yields from the use of nitrate of soda much superior and more profitable than those from the use of the other materials, while dried blood has given better results than sulphate of ammonia. . . . The one-third [160 lbs. per acre] rations did not contain enough nitrogen, the two thirds rations were the best balanced manures, and in the full rations some of the added nitrogen was unprofitable."

The results further indicate that "if in a single experiment one element is found lacking it does not necessarily follow that that element will be found most deficient if the experiment is carried on several years in succession," and show a gradual falling off in yield due to one-sided fertilizing during several years.

New method of applying liquid manure, L. F. KINNEY (*Rhode Island Sta. Rpt. 1895, pp. 277, 278, figs. 2*).—By connecting an opening in the side of a ½-in. hose with another hose leading to the liquid manure tank, the liquid manure drawn up by aspiration is mixed with the main stream when the water is turned on.

Phosphoric acid in agriculture, F. T. SHUTT (*Canadian Mining Review, 14 (1895), No. 7, pp. 125–129*).—A discussion of the natural sources of phosphoric acid, the amount of it in Canadian soil as shown by analyses made in the laboratory of the Experimental Farm, and the condition of phosphoric acid in the soil as shown by the work of Dyer and others. There are also notes on the use of superphosphates and data as to the loss of phosphoric acid by the export of agricultural products.

The value of green manuring on sandy and heavy soils (*Neue Ztschr. Rübenz. Ind., 35 (1895), No. 15, pp. 149–151; Hannover Land- und Forstw. Ztg., 1895, p. 631*).

The Schulz-Lupitz method of improving land by the growth of leguminous crops, L. GRANDEAU (*Jour. Agr. Prat., 59 (1895), Nos. 35, pp. 290, 291; 36, pp. 326–328; 37, pp. 364–366*).—A popular article.

Dangers from the use of town sewage as a fertilizer for pastures, F. CLAES and B. MOENS (*L'Engrais, 10 (1895), No. 40, pp. 949, 950*).—Surface application of town sewage on pastures is absolutely condemned on account of the danger of spread of disease, and it is recommended that such application should be confined entirely to cultivated soil.

General suggestions regarding the purchase of fertilizers, L. GRANDEAU (*Jour. Agr. Prat., 59 (1895), No. 44, pp. 613–616*).

Canada—a natural manufacturing center for fertilizers, H. WIGGLESWORTH (*Canadian Mining Review, 14 (1895), No. 7, pp. 129, 130*).

Canadian phosphate and fertilizers—home manufacture and home market J. B. SMITH (*Canadian Mining Review, 14 (1895), No. 7, p. 130*).

Phosphate's future, R. C. ADAMS (*Canadian Mining Review, 14 (1895), No. 7, p. 121*).—A discussion of facts and circumstances which are considered to warrant the hope that the mining of apatite will be revived.

Is superphosphate made from Tennessee phosphate susceptible of the sam reversion as that made from South Carolina and Florida phosphate? (*L'Engrais, 10 (1895), No. 29, p. 688*).—It appears that the pyrite which Tennessee phosphate contains is practically inert as regards reversion of the superphosphate produced.

Can soda replace potash? S. PEACOCK (*Cult. and Country Gent., 1895, June 20, p. 467*).

The purchase of Thomas slag on the basis of its content of citrate soluble phosphoric acid, A. EMMERLING (*Landw. Wochenbl. Schles. Holst., 45 (1895), No. 42, pp. 577-579*).

The sale of Thomas slag on the basis of citrate solubility (*Ztschr. angew. Chem., 1893, No. 13, p. 38*).

Fertilizer analyses, R. C. KEDZIE (*Michigan Sta. Bul. 126, pp. 16*).—This bulletin explains the objects of inspection of fertilizers and the results obtained by it, and gives directions for sampling, the text of the State fertilizer law, notes on valuation, and tabulated analyses of 60 samples of fertilizing materials, including mixed fertilizers, bone, Pamunkey phosphate, tankage, and fish guano.

Report of chemical division, H. J. WHEELER (*Rhode Island Sta. Rpt. 1893, pp. 273-276*).—A brief review of the work of the year is given and analyses of tankage, dissolved South Carolina rock, sulphate of potash, rubber waste, mixed fertilizer, wood ashes, gypsum, indigo waste, and 5 samples of water are reported.

The fertilizers and feeding stuffs act, 1893 (*Jour. [British] Bd. Agr., 1 (1895), No. 3, pp. 276, 277*).—Shows the number of analyses made under the act in 1894, indicating the extent to which the act was put into operation in England, Wales, and Scotland.

FIELD CROPS.

Alfalfa, or lucern, J. G. SMITH (*U. S. Dept. Agr., Farmers' Bul. 31, pp. 23*).—The topics treated are name, history, description, varieties, habits of growth, soils and conditions of growth, preparation of the soil, sowing the seed, alfalfa hay, weeds, cutting for seed, feeding value, soiling *vs.* pasturing, alfalfa for hogs, alfalfa in the orchard, chemical composition, alfalfa as a soil renovator, destroying alfalfa, and enemies of alfalfa, including weeds, root rot, spot disease, and animal pests.

"The Western alfalfa grows taller than the Eastern lucern, and is said to withstand drought and freezing better. . . .

"Alfalfa in the West very rarely kills out by winter freezing, although the temperature in certain regions in which it is largely grown is as low in winter as in the Eastern and New England States. In this latter section the plant frequently fails to go through the second season on account of the freezing of the roots. . . .

"Alfalfa will not thrive on fields where there is an excess of iron in the soil. . . . The most troublesome weed in alfalfa fields is the dodder, but as dodder seed is only about half as large as alfalfa seed, the former can be removed by the use of a suitable sieve."

Experiments with barley grown continuously, Hoosfield, Rothamsted, Sir J. H. GILBERT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 22, pp. 59-87*).—As compared with wheat, barley, which in

England is sown in the spring, has a much shorter period of growth and a more limited range of roots, and requires a lighter soil and finer surface tillage. The indications are that it is more dependent on the manurial supplies within the surface soil than is wheat.

The experiments in the continuous culture of barley extended through 43 years, 1852 to 1894, inclusive, and occupied nearly 30 plats. The soil was a somewhat heavy loam with a raw clay subsoil and chalk below, giving good natural drainage. With a few exceptions specially noted the same manure or fertilizer was applied year after year to the same plat during the entire period.

On the unfertilized plats the average yield per acre of barley for the first 20 years was 20 bu.; for the next 20 years only 13¼ bu., a decline of 33.8 per cent in the second period. This rate of decline was considerably greater than was found in the case of wheat. The average yield per acre for 40 years was on the unfertilized plat 16½ bu.; on the plat receiving annually an application of 14 tons stable manure per acre the yield was 48⅞ bu. During the first 20 years the stable manure plat averaged 48¾ bu.; that portion of it which, after 20 years of continuous manuring, received no further fertilization averaged during the 20 years when left without manure 30¼ bu. per acre. The residual effect of stable manure was conspicuous 23 years after the last application; thus the plats once manured produced in 1892, 1893, and 1894, respectively, 16¾, 12, and 13¾ bu. per acre more than the continuously unfertilized plats yielded in these same years. It was estimated that the manure supplied annually about 200 lbs. of nitrogen per acre, and that at the end of the first 20 years not more than 14 or 15 per cent of this large amount of nitrogen had been removed in the increase of crop.

The effects of applications of different commercial fertilizers are shown in the following table:

Summary showing the average produce of barley per acre per annum over 40 years, by different manures.

Plat		No nitrogenous manure	[illegible] lbs ammonium salts ([illegible] lbs N)[1]	[illegible] lbs sodium nitrate ([illegible] lbs N)[1]	1,000 lbs rape cake (49 lbs N[2])
	Dressed grain per acre:				
1	Without mineral manure ... bush.	16½	[illegible]	3[illegible]	41¼
2	Superphosphate ... do.	[illegible]	4[illegible]	[illegible]	43⅝
3	Potassium, sodium, and magnesium sulphates ... bush.	18	[illegible]	[illegible]	39¼
4	Superphosphate and potassium, sodium, and magnesium sulphates ... bush.	[illegible]	[illegible]	[illegible]	43½
	Straw per acre:				
1	Without mineral manure ... lbs.	[illegible]	1 7[illegible]	[illegible]	2 624
2	Superphosphate ... do.	1 [illegible]	[illegible]	[illegible]	2 792
3	Potassium, sodium, and magnesium sulphates ... lbs.	[illegible]	[illegible]	2 [illegible]	2 627
4	Superphosphate and potassium, sodium, and magnesium sulphates ... lbs.	1 270	2 904	[illegible] 186	2 875
	Total produce (grain and straw) per acre:				
1	Without mineral manure ... lbs.	1 [illegible]76	[illegible] 420	[illegible] 964	4 953
2	Superphosphate ... do.	[illegible]	[illegible] 080	5 596	5 251
3	Potassium, sodium, and magnesium sulphates ... lbs.	2 079	[illegible]	[illegible] 205	4 876
4	Superphosphate and potassium, sodium, and magnesium sulphates ... lbs.	[illegible]	5 [illegible]	5 761	5 319

[1] Ammonium salts: 86 lbs. nitrogen first 6 years, 43 lbs. next 10 years; sodium nitrate: 43 lbs. nitrogen each year since. [2] 2,000 lbs. rape cake first 6 years, 1,000 lbs. since.

The table shows that the increase of grain with nitrogenous fertilizers was very large; with superphosphate, considerable, and with salts of potash, soda, and magnesia, small.

"With the shorter period of growth of barley than of wheat, and its greater proportion of surface rooting, both nitrogenous and mineral exhaustion are sooner developed; and so far as mineral exhaustion is concerned the available supply of phosphoric acid was sooner exhausted than was that of potash. Indeed, in ordinary agricultural practice it is clearly established that superphosphate is more effective with the spring-sown than with the autumn-sown cereals."

With all commercial fertilizers there was a smaller yield in the second 20-year period than in the first 20 years.

The composition of the barley grain was influenced more by the season than by the character of the fertilizer applied. In favorable seasons, *i. e.*, those affording a large yield and heavy weight per bushel (which are taken as indications of a high degree of maturity), the grain contained a relatively high percentage of starch, total ash, and potash, and a relatively low percentage of nitrogen and phosphoric acid.

In wheat, however, there was not found a much higher percentage of potash nor a greater proportion of total ash in the grain of the highest quality. The fact that the chaff of barley is adherent and hence included in the analysis of the grain is regarded as at least in part an explanation of this difference between the two grains.

In barley straw the potash varied greatly, being influenced both by season and character of fertilizer. In the best seasons the ash of barley straw and also of wheat straw contained considerably less silica than in the worse seasons.

"This result is quite inconsistent with the usually accepted view that high quality and stiffness of straw depend on a high amount of silica . . . High proportion of silica means a relatively low proportion of organic substance produced. Nor can there be any doubt that strength of straw depends on the favorable development of the woody substance, and the more this is attained the more will the accumulated silica be, so to speak, diluted."

With full supplies of superphosphate and ammonium salts the amount of potash annually removed by the crop on an acre was, in the grain and straw, 25.4 lbs. without potash manuring, and 53.4 lbs. with potash fertilization. Without potash manuring the amount of potash in the straw declined from 22.5 lbs. per acre per annum in the first period of 10 years to 6 lbs. in the fourth period of 10 years. However, the amount of potash removed in the grain was only slightly reduced by the exhaustion of potash in the soil.

A study of the soil of the barley plats by B. Dyer showed that comparatively little of the applied potash or phosphoric acid had gone below the first 9 in. of soil and that none had gone below 18 in.

Crimson clover in Michigan, A. A. CROZIER (*Michigan Sta. Bul. 125, pp. 3-12*).—This article contains reports of more than 40 correspondents, in 17 counties in the State. The greater number of these reports were unfavorable. "Many of the sowings of crimson clover appeared to

pass the winter successfully, only to be killed by the freezing and thawing of early spring. . . . On sandy soil and rolling land the clover did the best, except where the soil was too dry or where the snow blew off. There was in some instances a failure to get a good stand owing to dry weather, and in many cases the growth when winter set in was less than was desirable. . . . Judging mainly from the experience of the past season, it seems probable that over most of the lower peninsula of Michigan crimson clover will not prove to be a satisfactory crop, though for certain locations, particularly along the western part of the State, it seems worthy of further trial. Under ordinary circumstances a smaller growth is to be expected here than in warmer climates."

Notes on Egyptian crops, G. P. FOADEN (*Notes on Egyptian Crops, March, 1895, pp. 9*).—This pamphlet, from Tewfikieh College of Agriculture, Ghizeh, Egypt, discusses Egyptian clover or berseem (*Trifolium alexandrinum*). The author speaks of 3 distinct varieties—Fachl, which makes a tall, luxuriant growth; Saida, which is trailing and will grow on dryer land than the former; and Muscowi, which requires an abundant supply of water by means of irrigation. When the last mentioned variety is sown as early as October 20 a cutting of forage is afforded in 45 or 50 days.

More than one cutting of Egyptian clover is usually made. In an experiment comparing the effects on later cuttings of cutting and of grazing, the former course afforded the larger yield. Brief directions are given for making stack silage from Egyptian clover or other forage plant.

Field experiments with corn, J. G. LEE (*Louisiana Stas. Bul. 35, 2d ser., pp. 1228–1234*).—Tests of fertilizers and varieties. This is in continuation of work reported in Bulletin 29 of the station (E. S. R., 6, p. 524). With every form of nitrogen used the yield of corn was largely increased. The most effective form of nitrogen was nitrate of soda, followed, in the order named, by dried blood, compost, cotton-seed meal, stable manure, fish scrap, and green cotton seed. With the use of phosphoric acid there was an increased yield, the most effective form being dissolved boneblack.

Potash failed to increase the yield. The author recommends the use of 50 lbs. of nitrogen and 36 lbs. of phosphoric acid, with not more than 13 lbs. of potash.

In the dry season of 1894 fractional applications of fertilizers were less profitable than a single application.

Results on old lands favored the use of 3 lbs. of cotton-seed meal for each pound of superphosphate.

Detasseling corn, C. D. SMITH, J. T. BERRY, and A. A. CROZIER (*Michigan Sta. Bul. 125, pp. 37–40*).—The tassels were removed every week day from alternate rows of corn, care being taken to pull them as soon as they were half emerged from the leaves In detasseling

considerable injury was done the upper leaves of the plant. The silks were more numerous and appeared earlier on the detasseled rows than on those untreated. The detasseled rows yielded only about 5 per cent more grain than the others, an increase which was insufficient to pay the cost of detasseling. The detasseled rows yielded less stover.

Field experiments with cotton, J. G. LEE (*Louisiana Stas. Bul. 35, 2d ser., pp. 1213–1228*).

Synopsis.—Tests of fertilizers and varieties. Nearly every form of nitrogen employed was advantageous, that in compost being most effective. Phosphates also increased the yield, and potash produced little or no effect. Of 37 varieties tested the most productive was Louisiana.

This is a continuation of work at the North Louisiana Station, reported in Bulletin 29 (E. S. R., 6, p. 529).

Fertilizer experiments (pp. 1213–1225).—Potash, phosphoric acid, and nitrogen were used alone and in various combinations on 27 plats. From the results obtained the author recommends the use of 36 to 54 lbs. of phosphoric acid and 50 lbs. of nitrogen per acre, with not more than 13 lbs. of potash.

Special potash, phosphoric acid, and nitrogen experiments occupied 27 plats. Nitrogen was most effective when employed in the form of compost; the other forms of nitrogen were effective in the order named: Nitrate of soda, cotton seed meal, sulphate of ammonia, dried blood, stable manure, fish scrap, and green cotton seed. Results on 4 plats indicated that for old land the best proportions of cotton-seed meal and superphosphate were 3 lbs. of the former for each pound of the latter.

Varieties (pp. 1225–1228).—Yields of 37 varieties are tabulated. Of 23 Egyptian varieties 9 were regarded as worthy of further trial; the most productive was the variety Louisiana, which for 40 years had been grown in India. Of 4 long staple American varieties the largest yield was made by Allen; of 6 short-limbed varieties, by Gold Dust; and of 4 cluster varieties, by Tyler Lint Cluster.

Grasses of Ontario, F. C. HARRISON and G. E. DAY (*Ontario Agl. College and Exptl. Farm Bul. 99, pp. 66, pls. 28*).—A semipopular manual of the more important forage grasses in the Province of Ontario. The following grasses are figured and described: Timothy, perennial rye, orchard grass, meadow fescue, sheep's fescue, tall oat grass, Kentucky blue grass, Canadian blue grass (*Poa compressa*), redtop, meadow foxtail, Hungarian millet, vernal grass, *Muhlenbergia mexicana*, wild rye, Canadian blue joint (*Calamagrostis canadensis*), *Glyceria canadensis*, *Muhlenbergia glomerata*, reed canary grass, fowl meadow grass, *Hierochloe borealis*, barnyard grass, couch grass, chess, wild oat, and yellow foxtail.

Appended to the descriptions are brief popular remarks on the value of the various grasses. Directions are given for the preparation of various grass mixtures, with observations as to their proper sowing.

The bulletin ends with a table of compiled analyses of the composition of the grasses described.

Experiments on the growth of various leguminous crops for many years in succession on the same land, Sir J. H. GILBERT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 22, pp. 88–119*).—The principal topics presented are the amounts of nitrogen stored up in various leguminous crops, the effects of nitrogenous fertilizers on leguminous crops, and the difference in the capacity of field soil and garden soil to grow clover. Beans and clover on a given area stored up much larger amounts of nitrogen than did wheat, barley, or roots. Thus in 1873 the nitrogen in a crop of barley was only 37.3 lbs. per acre, while in an adjacent crop of clover it amounted to 151.3 lbs. In 1874 barley was sown on both plats; when it followed barley the nitrogen stored up in the crop of 1874 was 39.1 lbs.; but on the plat where clover in the preceding year had removed so much nitrogen the barley crop of 1874 contained 69.4 lbs. of nitrogen, indicating the high manurial value of clover stubble. After both clover and barley were harvested in 1873 it was found that the upper 9 in. of soil was richer in nitrogen on the clover plat than on the plat which had grown barley.

Nitrogenous manure produced less effect on leguminous plants than on grains and roots. Thus for every pound of nitrogen (applied as nitrate of soda in combination with minerals) the carbohydrates stored up in the total produce of beans averaged only 5.5 lbs., in potatoes 16.5 lbs., in mangel wurzel roots 32.2 lbs., in grain and straw of wheat 36.5 lbs., and in sugar beet roots 47.1 lbs.

The total produce of 26 crops of beans grown in a period of 32 years averaged without fertilizers 1,709 lbs. per acre, with mixed minerals 2,688 lbs., and with mixed minerals together with nitrogen 3,086 lbs. Nitrogenous fertilizers were not applied every year. Ammonium salts were first applied, but when it was observed that nitrate of soda was more beneficial to leguminous crops this fertilizer was substituted. In continuous culture the yield of beans tended to decline, but improved after a few years of fallow.

"It may be observed that nitrogen supplied as ammonium salts to the highly nitrogenous leguminous crop seldom gives any increase, and is sometimes injurious in the year of application, though some benefit may afterwards result from the residue after the ammonia has been converted into nitric acid. Even nitrates, however, directly applied as manure, are very uncertain in their action. . . .

"It is specially to be noted that while the cereal crops may be successfully grown for many years in succession on the same land, provided only that mineral and nitrogenous manures are liberally supplied, this leguminous crop, beans, gradually fails when so grown . . .

"The result is, however, not entirely due to deficiency in the supply of constituents within the soil, but is also in a considerable degree dependent on the fact that by the continuous growth of the crop, with its special habit and range of roots, the surface soil acquires a close and unfavorable condition, and a somewhat impervious pan is formed below."

The 26 bean crops previously mentioned contained in seed and straw an average of 30.5 lbs. of nitrogen when no fertilizer was applied, 43.9 lbs. when mixed minerals were employed, and 52.2 lbs. when mixed minerals and nitrogenous fertilizers were used.

Red clover was sown on the same land 15 times in 29 years, but in only 7 was any clover obtained.

"It is, indeed, fully recognized that in our own country clover will not grow under ordinary conditions more frequently than once in a certain number of years, which varies according to soil and other circumstances, but is seldom so few as 4, and frequently as many as, or more than, 8 years."

On land receiving an occasional dressing of minerals 7 crops of red clover averaged 4,416 lbs. of hay per acre, containing 100.1 lbs. of nitrogen; where, in addition to minerals, nitrogen was occasionally applied, the 7 crops averaged 4,668 lbs. of hay containing 109.3 lbs. of nitrogen.

In marked contrast with the failure to grow frequent crops of red clover on ordinary arable soil, was the success in getting excellent crops of clover hay for 40 years in succession on rich garden soil without any nitrogenous fertilizer. The garden surface soil contained 4 or 5 times as much nitrogen as the field soil. The following table gives the average annual yields of hay, dry matter, minerals, and nitrogen for the small garden plat:

Yields per acre of hay, dry matter, ash, and nitrogen with red clover grown continuously on rich garden soil.

[Average per acre per annum.]

	Hay	Dry matter	Ash	Nitrogen
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
10 years, 1854-'63	10,689	8,908	1,063	257
10 years, 1864-'73	5,561	4,631	489	133
10 years, 1874-'83	5,099	4,249	507	122
10 years, 1884-'93	5,202	4,335	482	125
40 years, 1854-'93	6,638	5,532	620	159

The average amount of nitrogen stored up per acre per annum in clover hay averaged for 40 years 159 lbs., but in the second year the nitrogen was estimated at 435 lbs. per acre. "There would seem, then, to be clearly indicated a soil source of failure on the arable land and a soil source of success on the garden soil."

Soil samples taken a few years after this test on garden soil was begun, and again 21 years later, showed that the nitrogen in the dry fine earth of the surface soil had declined from 0.5095 per cent to 0.3634 per cent. The former figure represented 9,528 lbs. of nitrogen in an acre of surface soil 9 in. deep, and the latter a loss of 2,732 lbs. after 21 years of clover culture without fertilization, or an average annual loss in soil nitrogen of 130 lbs. per acre.

With this decline in the nitrogen content of the surface soil there was "a very marked reduction in the clover-growing capacity of the

soil. . . . While fresh seed was only sown 5 times during the first 20 years, it has been fully or partially sown 21 times during the last 20 years." During the period that the soil lost annually 130 lbs. of nitrogen the crop removed annually more than 160 lbs. of nitrogen.

"Notwithstanding the very little effect of direct nitrogenous manures on either the beans or the clover growing on the ordinary arable land, there would seem to be very clear evidence of a soil source of, at any rate, much of the enormous amounts of nitrogen assimilated over a given area by the clover growing on the rich garden soil."

Investigations of the clover crop grown on a somewhat exhausted soil and of the surface soil, which during 3 years of clover culture had become determinably richer in nitrogen, led to the conclusion that the source of a part of the nitrogen must be either the subsoil or the atmosphere. The amounts of nitrogen existing as nitric acid in soil and subsoil at different depths on plats cropped with different leguminous plants are discussed.

Of 11 different Leguminosæ tested, only white clover (*Trifolium repens*), vetch (*Vicia sativa*), Bokhara clover (*Melilotus leucantha*), and alfalfa gave satisfaction when grown continuously on the same land.

On red-clover exhausted soils, with mineral, but without nitrogenous fertilizers, the nitrogen in crops of red clover averaged 22 lbs. per acre, in white clover 47 lbs., in vetch 75 lbs., in Bokhara clover 64 lbs., and in alfalfa 160 lbs. The crop (above ground) of alfalfa 1 year old contained 327 lbs. of nitrogen per acre.

Analyses of the soil of the plats showed that when cropped with vetch, white clover, Bokhara clover, vetch, and alfalfa the surface soil gained in nitrogen.

Experiments with root crops grown continuously, Barnfield, Rothamsted, Sir J. H. GILBERT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 22, pp. 17-58*).—These experiments were begun in 1842. The crops grown on the same land were Norfolk white turnips for 7 years, followed by ruta bagas or Swedish turnips for 4 years, barley without manure for 3 years, again ruta bagas for 15 years, sugar beets for 5 years, and mangel wurzels for 17 years. The general plan, from which there were some departures, was to apply a phosphate and a potash manure, alone, together, and in combination with different amounts of nitrogen, either as nitrate of soda, ammonium salts, or rape cake, or ammonium salts and rape cake. Barnyard manure was also used alone and in combination with one or more chemical fertilizers. The leaves of the root crops were always left on the land.

Results are detailed showing that turnips, instead of being a restorative crop, as is sometimes assumed, constitute a very exhausting one unless liberally manured. The absence of fertilizers for 3 years on turnip land influenced the composition of the crop; when the yield per acre fell below 1 ton the dry matter of these dwarfed roots contained 3.31 per cent of nitrogen against about $1\frac{1}{2}$ per cent of nitrogen for turnips grown in normal amounts on fertilized plats. The lower content

of nitrogen in the larger fertilized roots was attributed to their having stored up a large amount of non-nitrogenous substances, diluting the nitrogen, so to speak.

The ratio between the weight of leaves and roots for the several crops was as follows:

Ratio between weight of leaves and roots.

	Leaves.	Roots.
	Pounds.	*Pounds.*
Ruta bagas	61.8 to 228	1,000
Mangel wurzels	152.0 to 216	1,000
Sugar beets	205.0 to 354	1,000
Norfolk white turnips	329.0 to 600	1,000

In every case the greatest proportion of leaves was found where liberal amounts of complete fertilizers were used and where consequently there was the rankest growth.

The weight of dry matter per acre in the roots of 4 crops of white turnips averaged, with mineral manures alone, 1,581 lbs.; with minerals and ammonium salts, 1,807 lbs.; with minerals and ammonium salts supplemented by rape cake, 1,770 lbs.; and with minerals and rape cake, 1,963 lbs.

The weight of dry matter per acre in the roots of 4 crops of ruta bagas averaged, with minerals alone, 1,879 lbs.; with minerals and ammonium salts, 2,245 lbs.; with the last mixture plus rape cake, 2,840 lbs.; and with minerals and rape cake, 2,769 lbs. In later years the yields were smaller, averaging for 10 years, with minerals and ammonium salts, 1,084 lbs., and with minerals and nitrate of soda, 1,285 lbs. of dry matter per acre.

"[With sugar beets] mineral manures alone give an average of less than 6 tons of roots, the addition of nitrate of soda raises the produce to nearly 19 tons, that of ammonium salts to nearly 15 tons, that of rape cake to nearly 18 tons, and that of rape cake and ammonium salts together to more than 22 tons. . . . . With superphosphate and potash as the mineral manure, there was an average annual increase of sugar yielded per acre, due to the nitrogenous supply, of 2,931 lbs. by the nitrate, of 2,359 lbs. by the ammonium salts, of 3,575 lbs. by the ammonium salts and rape cake, and of 3,084 lbs. by the rape cake. . . . Upon the whole, therefore, it is evident that even with a full supply of mineral manure the produce of sugar was small, and that the increased production of that non-nitrogenous substance was dependent on the available supply of nitrogen within the soil. . . . . It is remarkable that with the same mineral supply in each case there was without nitrogen less than 2 cwt. of mineral matter per acre per annum in root and leaf together, while with the highest nitrogenous supply in addition there was more than 7¼ cwt. of mineral matter removed in the crop. There is here evidence both of how liberal must be the supply of available mineral constituents for the luxuriant growth of the [sugar beet] crop and how great will be the exhaustion of them if the crop be sold off the farm."

The residual effects on sugar beets of various fertilizers are tabulated and discussed.

"In the case of the nitrate and ammonium salts the effect of residue will be in the least proportion due to manure residue and in the greatest to crop residue.

With such manures as rape cake the effect will be due in a large proportion to manure residue and also largely to crop residue With farmyard manure, so far as there had been larger crops, there will be much crop residue, but a very large proportion of the effect on future crops is to be attributed to slowly decomposing manure residue."

Taking as a basis the yield of sugar on the plat without nitrogenous fertilizer, the following table gives the increase in the sugar produced for every pound of nitrogen supplied to the other plats

Increase in sugar produced for every pound of nitrogen supplied in the fertilizers

Fertilizer	Increase in sugar: With sugar beets	Increase in sugar: With mangel wurzels
	Pounds	*Pounds*
Nitrate of soda and superphosphate	34.1	17.1
Nitrate of soda superphosphate and potash	34.1	20.7
Ammonium salts and superphosphate	21.3	8.5
Ammonium salts superphosphate and potash	27.4	17.8
Ammonium salts rape cake and superphosphate	[1]11.7	[1]15.0
Ammonium salts rape cake superphosphate and potash	[1]19.4	[1]12.8
Rape cake and superphosphate	27.3	12.3
Rape cake superphosphate and potash	31.5	19.6

[1] Double ration of nitrogen

In every case but one a pound of nitrogen was more effective when both superphosphate and potash were present than when potash was omitted.

"It will be found that nitrogenous manures are chiefly used for crops poor in nitrogen, the increased produce of which is characteristically that of non nitrogenous bodies Without attempting to give a physiological explanation of the result, it may at any rate be stated as a matter of fact that nitrogenous manures greatly increase the general vegetative activity of such plants and consequently, if the other necessary supplies are not wanting, the activity of the formation of their natural or characteristic products is enhanced The supply of potash, as well as of nitrogen has much to do with the amount of root development and the amount of sugar produced"

Under most normal conditions of growth there was produced about 40 lbs. of sugar for every pound of potash contained in the roots of sugar beets.

The following table gives the percentages of the manurial nitrogen taken up or utilized by the crop (exclusive of leaves) of both sugar beets and mangel wurzels when a complete fertilizer was applied:

Percentages of applied nitrogen utilized by the roots of sugar beets and mangel wurzels.

	Sugar beets	Mangel wurzels
	Per cent	*Per cent*
With nitrate of soda and minerals	61.3	59.9
With ammonium salts and minerals	42.9	43.3
With rape cake and minerals	45.0	49.3
With rape cake ammonium salts, and minerals	49.6	45.9

"To summarize in regard to the mangel wurzel results, there is the more sugar produced the larger the amount of nitrogen supplied but by no means in proportion to the amount supplied The efficiency of a given amount of nitrogen is greatly dependent on the completeness of the accompanying mineral supply, and especially

on that of potash. Again, the greater the excess of nitrogen the greater the luxuriance and the less ripe the roots, and the less is the amount of sugar obtained for a given amount of nitrogen supplied."

The percentages of the total nitrogen existing as albuminoids, amids, and nitrates in ruta-bagas and mangel-wurzels differently manured are tabulated.

The following table gives the average percentages of dry matter and sugar in white turnips, yellow turnips, ruta-bagas, and mangel-wurzels:

Estimates of the approximate average percentages of dry matter, and of sugar, in different descriptions of roots.

	Dry matter	Sugar	
		In fresh roots	In dry matter.
	Per cent	*Per cent*	*Per cent.*
White turnips	8.0	3.5 to 4.5	44 to 56
Yellow turnips	9.0	4.0 to 5.0	44 to 56
Swedish turnips	11.0	6.0 to 7.0	55 to 64
Mangel wurzels	12.5	7.5 to 8.5	60 to 68

Fertilizer experiments and variety tests with sugar cane, J. P. D'ALBUQUERQUE (*Rpt. Exptl. Fields, Dodds Reformatory, Barbados, 1894, pp. 11*).—The fertilizer experiments consisted of tests to ascertain the most profitable amounts of nitrogen, phosphoric acid, and potash, and the relative values of single and fractional applications of these fertilizing materials. In all these experiments there were diseased canes; conclusions are deduced only for the special nitrogen experiment.

With nitrogen at the rates of 40 and 60 lbs. per acre the yield was largely increased. This was true whether the nitrogen applied was in the form of sulphate of ammonia, nitrate of soda, or dried blood. With both sulphate of ammonia and dried blood fractional applications afforded large yields. However, a deterioration in the quality of juice was observed whenever the second application of sulphate of ammonia (in July) supplied more than 40 lbs. of nitrogen per acre. The most profitable returns were obtained on the plat which, besides mixed minerals, received sulphate of ammonia supplying 15 lbs. of nitrogen in January and 25 lbs. in July.

Single applications of nitrogen in July proved unprofitable. Determinations of phosphoric acid and potash as well as of sugar were made in the canes differently fertilized.

The yields and analyses of varieties and seedlings are tabulated in detail. Varieties affording large yields were Lahaina and Queensland Creole; those especially rich in sugar were Tamarind, Striped Singapore, and Caledonian Queen.

Incidental reference is made to diseases of sugar cane and to their prevalence on certain soils.

Experiments on the growth of wheat for 50 years in succession on the same land, Broadbalk Field, Rothamsted, Sir J. H. GILBERT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 22, pp.*

146–171, diag. 1).—The results of these experiments show the effects of soil exhaustion from continuous culture of wheat on plats receiving no fertilizer or various chemical fertilizers, and indicate the manurial needs of the wheat plant on the soil of the Rothamsted estate. "The unmanured and the barnyard manure plats have, respectively, been treated exactly in the same way in each of the 50 years. The artificially manured plats, however, as a rule did not receive the same manure from year to year during the first 8 years, 1844–'51; but, with a few special exceptions, each has been treated uniformly during the 42 years, 1852–'93, inclusive."

On the plat receiving annually 14 tons per acre of barnyard manure the average yield during the first period of 20 years was 35¾ bu. of wheat per acre, during the second period of 20 years it was 33½ bu., the average for the entire 40 years being 34⅝ bu. The author estimates that the average annual increase in the yield was a little over ⅛ bu. per acre, independent of season. On the plat continuously without manure the average yield for 40 years was 13 bu. per acre. Here the average decrease was about ⅛ bu. per acre during each of the 40 years. The average yield for 40 years was on the mixed mineral plat 15 bu.; where ammonium salts supplying 86 lbs. of nitrogen per acre were used alone, 20⅛ to 22½ bu.; and where the same nitrogenous fertilizer (on 2 series of plats) was applied biennially and in alternation with mixed minerals the yield for the years when nitrogen was applied was 30½ bu. Ammonium salts applied in the fall had no residual effect on wheat, but influenced only the crop to which they were applied.

The following table records the effects of using ammonium salts and nitrate of soda, and different quantities of the former.

Wheat grown for more than 50 years in succession on the same land, commencing 1843–'44.

	Superphosphate and sulphates potash, soda, and magnesia					
	Alone	And ammonium salts (=43 lbs nitrogen)	And ammonium salts (=86 lbs nitrogen)	And ammonium salts (=129 lbs nitrogen)	And sodium nitrate (=86 lbs[1] nitrogen)	Sodium nitrate alone (=86 lbs[2] nitrogen)
Plats	5	6	7	8	9a	9b
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
8 years, 1852–59	19	27⅛	35¾	36	41⅛	26⅛
8 years, 1860–67	16	26¼	36¼	39¼	40¼	27⅞
8 years, 1868–75	14	22	31	36	39	22⅞
8 years, 1876–83	12¼	20⅞	28	32¼	34¼	18¾
8 years, 1884–91	13⅞	24⅞	33	38¼	32	20
20 years, 1852–71	17	26⅞	37¼	38¼	36⅝	26
20 years, 1872–91	12⅞	21¼	31	34¼	34	19⅜
40 years, 1852–91	15	24⅛	33⅛	36⅛	35⅞	22⅜
Excess of average crop over plat 5, in bushels		9⅛	18⅛	21⅛	20⅜	7⅜

[1]9a Nitrate of soda equal 74 lbs. nitrogen in 1852, equal 43 lbs. nitrogen in 1853 and 1854, equal 86 lbs. nitrogen in 1855 and each year to 1884 inclusive, and equal 43 lbs. nitrogen in 1885 and each year since. No mineral manures applied in 1852, 1853, or 1854.

[2]9b Nitrate of soda equal 74 lbs. nitrogen in 1852, equal 86 lbs. nitrogen in 1853 and each year to 1884 inclusive, and equal 43 lbs. nitrogen in 1885 and each year to 1893 inclusive. In 1894 manured exactly as Plat 9a.

The yield with mixed minerals was only 2 bu. per acre greater than on the unfertilized plat. A single ration of 43 lbs. of nitrogen gave an average increase of 9¼ bu. per acre; the second ration of 43 lbs. an increase of 9 bu. over the single ration; and the third addition of a like quantity of nitrogen afforded a yield only 3⅜ bu. in excess of the yield with double rations.

"This result affords an illustration of the inapplicability of conclusions from manure experiments when the condition of the land is too high already, or when an excess of manure is applied. . . .

"In the case of the wheat there was much more effect from a given amount of nitrogen supplied as nitrate, which was always applied in the spring, than from an equal quantity as ammonium salts, which was applied in the autumn, when the nitrogen would be subject to winter drainage. There was more effect from a given amount of ammonium salts applied to barley than to wheat; the application having been made for the barley in the spring, and for the wheat in the autumn."

When wheat and barley were manured with ammonium salts alone there was a larger percentage of nitrogen in the dry matter, and of chlorophyll in the green plant, than when both ammonium salts and minerals were used. However, with the complete manuring and the resulting lower percentages of nitrogen and chlorophyll there was a greater assimilation of carbon than with a nitrogenous fertilizer alone.

"It is evident that the chlorophyll formation has a close connection with the amount of nitrogen assimilated; but that the carbon assimilation is not in proportion to the chlorophyll formed if there is not a sufficiency of the necessary mineral constituents available. No doubt there had been as much or more of both nitrogen assimilated, and chlorophyll formed, over a given area, where the mineral as well as the nitrogenous manure had been applied, the lower proportion of both in the dry matter being due to the greater assimilation of carbon, and consequent greater formation of non-nitrogenous substance. . .

"The relative excess of nitrogen in the soils of the different plats is little, if at all, due to the direct retention of the nitrogen of the manure; and it is almost exclusively dependent on the difference in the amounts of the crop residues (of the stubble and roots, and perhaps of weeds), of which there will be the more the greater the amount of crop grown."

The following table summarizes the results following the use of various mineral fertilizers applied in combination with a constant kind and amount of nitrogen:

Yields per acre of wheat continuously fertilized with various combinations of mineral manures, with and without ammonium salts

		400 lbs. ammonium salts (= 86 lbs. nitrogen per acre per annum)						
	Mixed mineral manure alone	Alone 1852 and since (previously mineral manure 1844, ammonium salts 1845–51)	Alone 1852 and since (previously mineral manure 1844, 1848, and 1850, ammonium salts 1845, 1847, 1848, 1849, and 1851)	And superphosphate	And superphosphate and sulphate of soda	And superphosphate and sulphate of potash	And superphosphate and sulphate of magnesia	And superphosphate and sulphates of potash, soda, and magnesia
Plat	5	10*a*	10*b*	11	12	13	14	7
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
8 years, 1852–59	1[illegible]	[illegible]	[illegible]7¼	[illegible]9⅜	34¼	33⅝	34¼	35¼
8 years, 1860–67	15¾	[illegible]4	27¼	[illegible]9¼	35	31⅞	34⅞	36½
8 years, 1868–75	14	19	20[illegible]	[illegible]3⅜	30	1[illegible]	30⅞	31
8 years, 1876–83	1[illegible]⅜	16	18⅝	[illegible]	24¾	27	27	28
8 years, 1884–91	11¼	18¼	19¼	[illegible]1	2[illegible]	[illegible]¼	30½	34¾
20 years, 1852–71	17	[illegible]½	25⅞	28	[illegible]3⅞	[illegible]⅞	33⅞	35¼
20 years, 1872–91	12⅞	17[illegible]	19	2[illegible]¼	[illegible]	2[illegible]⅝	28⅞	31
40 years, 1852–91	15	[illegible]	[illegible]¼	[illegible]	[illegible]¾	31¼	31⅜	33½

"The results on the artificially manured plats show that mineral manures alone gave very little increase of produce; that nitrogenous manures alone gave considerably more than mineral manures alone; but that mixtures of the two gave very much more than either separately."

Under different conditions as to potash manuring "there was about 1½ times as much stored up in the total produce over the 40 years where there was accumulation [of potash] from previous applications as where none had been supplied, and more than twice as much where there had been full annual supply. The evidence is clear, therefore, that the residue from potash applied before the commencement of the 40 years had been available to the succeeding crops."

The yields of wheat differently fertilized during 8 years at Woburn, 3 years at Holkham, Norfolk, and 4 years at Rodmersham, Kent, are tabulated, and the results in the main accord with those obtained at Rothamsted in two different fields.

The author discusses the soil of the wheat plats and incidentally touches on soil exhaustion in the United States.

Field experiments with wheat, W. C. LATTA (*Indiana Sta. Bul. 56, pp. 59–68*).

Synopsis.—These experiments are classed under the following heads: (1) Test of varieties, (2) quantity of seed per acre, (3) early and late sowing, (4) effect of change of soil, and (5) coöperative test of varieties. In 1895 the largest yields were made by Valley, by sowing 2 pecks of seed per acre, and by sowing in September. A change of soil for seed wheat was not followed by marked results.

These experiments, conducted in 1895, are in continuation of those recorded in Bulletin 51 of the station (E. S. R., 6, p. 413).

Test of varieties (pp. 59, 60).—Tabulated data give the yields for 46 varieties of wheat tested in 1895 and the average yields of varieties tested from 1 to 12 years. Valley afforded the largest yield, 29.12 bu. per acre, and was followed in the order named by Pride of Illinois, American Bronze, and Willits.

Quantity of seed per acre (p. 61).—In 1895 2 pecks of seed per acre afforded a larger yield than 3, 4, 5, 6, 7, 8, 9, or 10 pecks. Taking the averages for 11 years the results indicate that at least 6 pecks and not more than 8 pecks should be used.

Early and late sowing (p. 62).—The results indicated the 20th of September as a desirable date for sowing.

Effect of change of soil (pp. 62–64).—In 1893 seed wheat was sent from the station to localities in the northern, central, and southern parts of the State and seed from the resulting crop was sown at the station in 1894 in comparison with the same varieties grown continuously on the station farm. Velvet Chaff grown continuously at the station averaged 19.22 bu. per acre; seed grown elsewhere averaged 19.17 bu. Michigan Amber grown continuously at the station produced 18.42 bu. per acre; from seed grown elsewhere this variety averaged 22.19 bu.

Coöperative experiments with varieties (pp. 64–68).—These were conducted in 4 counties, 4 to 6 varieties being tested in each locality. The best average yield for all localities during 2 years was afforded by Jones Fife, 29.31 bu. per acre. "Varieties of wheat not only show marked differences in yield, hardiness, quality, etc., but also in their adaptation to particular soils and climatic conditions."

The advantages of rotation are pointed out.

Experiments with winter wheat, C. A. ZAVITZ (*Ontario Agl. College Bul. 100, pp. 11*).—In 1895 102 varieties of winter wheat were tested. The yields for 1895 and the average yields of each variety for a number of years are tabulated. The varieties making the largest yield were, among those grown for 4 years, Dawson Golden Chaff, Early Red Clawson, and Egyptian; among those grown 3 years, Stewart Champion, Early White Leader, and Soule; among those grown 2 years, Early Genesee, Giant, and Siberian; and among those grown 1 year, Michigan Amber, Giant Square Head, and White Bearded. None of the European varieties proved especially valuable. The smooth varieties averaged during 6 years 38.8 bu. of wheat per acre, the bearded varieties 37.1 bu. The white varieties during the same time averaged 39.3 bu.,

the red varieties 37.7 bu. The amount of straw was practically the same with smooth, bearded, white, and red varieties. Sowing later than September 9 resulted in a decreased yield. In an experiment comparing broadcast seeding and drilling the yield of grain was the same when equal quantities of seed were employed in the 2 methods. Two bushels of seed afforded a larger yield than $1\frac{1}{2}$ and 1 bu. The yield was larger with late cutting than with early or medium cutting of winter wheat. Seed from a crop cut late was more productive than seed from a crop cut early or at a medium date.

Harvesting wheat at successive stages of ripeness, P. G. HOLDEN and L. J. BRIGGS (*Michigan Sta. Bul. 125, pp. 34–36*).—Wheat was cut in the milky stage, the dough stage, when yellow ripe, and when dead ripe.

"One hundred grains at each stage of maturity were shelled out and weighed immediately upon cutting, giving the weights which appear in the first column of the table.

"In the second column are the weights of 4 similar samples of 100 seeds each from grain which was left in the head detached from the straw until matured.

"In the next series the straw was cut the usual length and the grain left in the heads upon the straw until fully cured.

"The last treatment consisted in placing the entire stems with the roots attached, but thoroughly cleansed from adhering soil, in a jar of distilled water in a light airy basement until all were thoroughly ripened, replenishing the water as it evaporated."

Wheat cut at successive stages of maturity and subjected to different treatments.

Time of harvesting.	Weight of 100 kernels.				
	Shelled and weighed immediately upon cutting.	Ripened in the head.	Ripened in the straw.	Ripened with the roots on.	Average weights at successive stages of maturity.
	Mg.	*Mg.*	*Mg.*	*Mg.*	*Mg.*
June 19, milky stage	1.077	1.11[illegible]	1.521	1.905	1.400
June 30, dough stage	3.8[illegible]8	[illegible]	4.0[illegible]1	4.083	3.962
July 13, yellow ripe	4.850	4.965	5.03[illegible]	5.191	5.008
July 24, dead ripe	4.815	4.917	[illegible].030	4.66[illegible]	4.862
Average weights for the different treatments	3.65[illegible]	3.709	[illegible]09	3.960	

The weight of grain harvested when yellow ripe or when dead ripe was considerably greater than that of more milky grain. The grain derived considerable weight from the straw after cutting and a smaller increase was made when the head was detached from the straw. The germinating power of kernels harvested at 4 stages of maturity was tested. The kernels harvested in the milky stage sprouted first, but their percentage of germination was the lowest, and the resulting plants were less vigorous than those from more mature seed.

Planting at different depths, P. G. HOLDEN, F. P. CLARK, and A. A. CROZIER (*Michigan Sta. Bul. 125, pp. 32, 33*).—Seeds of wheat, oats, flax, corn, barley, clover, peas, and buckwheat were planted in boxes containing sand, loam, and clay soils, the depth of planting ranging

from ½ in. to 12 in. The highest percentage of germination for wheat, flax, corn, and clover was at a depth of 1 in.; for oats, 2 in.; for barley, ½ in. (closely followed by 1 and 2 in.); for peas, 4 in.; and for buckwheat, 2 in. Clover entirely failed when the depth was greater than 2 in. Some plants of oats, corn, and peas appeared above ground when the depth of planting was 8 in. or more.

Rotation of crops, C. O. FLAGG (*Rhode Island Sta. Rpt. 1893, pp. 176–195*).—The advantages of rotation of crops are discussed and descriptions of the various rotations now under test are given. The article also includes tabulated data giving the yields of cowpeas, spring vetch, white lupine, blue lupine, yellow lupine, serradella, spurry, and several other varieties of peas, beans, and soja beans all grown on plats receiving minerals alone, and medium and heavy applications of nitrate of soda in combination with minerals; of 15 varieties of potatoes, and of clover grown on land limed and not limed. The gain in the yield of clover hay from liming was 34 per cent.

Alfalfa, A. A. CROZIER (*Michigan Sta. Bul. 125, pp. 29, 30*).—As the result of experience with alfalfa at the station the author recommends this plant for further trial throughout the State.

Variety tests of barley, flax, field peas, and millet, W. M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 271–275*).—A reprint from Bulletin 40 of the station (E. S. R., 7, p. 121).

Analyses of cereals collected at the World's Columbian Exposition, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Bul. 45, pp. 57*).—Analyses of samples of barley, buckwheat, Indian corn, oats, rice, rye, and wheat arranged by States and Territories, and of oat hulls. The methods of analysis used are described and the average results of analyses of the different grains are discussed.

The chemical development and value of red clover, H. SNYDER (*Minnesota Sta. Rpt. 1894, pp. 17–33*).—A reprint of Bulletin 34 of the station (E. S. R., 6, p. 522).

Clover for the silo, E. H. BANCROFT, F. H. KING, and C. S. PLUMB (*Rural New Yorker, 1895, Nov. 16, pp. 760, 761*).—Directions for making clover silage.

Clover sown every month in the year, A. A. CROZIER (*Michigan Sta. Bul. 125, pp. 13, 14*).—Red clover was sown during the latter part of each month in the year. Success resulted only when seeding was made in February, March, April, and December. The July seeding failed to come up until the fall rains began, and the plants from seeding in July, August, September, and October succumbed to the winter.

Common names of the clovers, A. A. CROZIER (*Michigan Sta. Bul. 125, pp. 14–28*).—This article consists of an alphabetical list giving the common names in English, a translation of the common French and German names, and the botanical names applied to plants sometimes or generally called clovers. There is also a list of these same plants arranged by genera and species.

Field experiments with corn, W. M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 233–237, 245–254*).—A reprint from Bulletin 40 of the station (E. S. R., 7, p. 113).

Tropical fodder grasses (*Kew Misc. Bul. 105, pp. 209–211*).—Brief notes are given of the estimate placed on *Andropogon pertusus* and *Bouteloua juncifolia* in Barbados.

Experiments with manures on natural meadows, E. ZACHAREWICZ (*Ann. Agron., 21 (1895), No. 4, pp. 181–184*).

A note on experimental grass gardens, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circular 1, pp. 4*).—Notes on the importance of testing forage plants and brief statements relative to the grass gardens established by the Division, the one on the grounds of this Department and the other at the Tennessee Agricultural Experiment Station.

Experiments with forage crops, rice, oats, and barley, J. G. LEE (*Louisiana Stas. Bul. 35, 2d ser., pp. 1234–1236*).—Approximate yields are given of several varieties of Kaffir corn, millet, sorghum, and rice. The greatest yield of forage was afforded by large African millet. Two hundred pounds of cotton-seed meal and 100 lbs. of acid phosphate on rust-proof oats and winter barley gave much larger yields than no fertilizer. Fall application of the fertilizer gave better results than spring application.

Field experiments with oats and mixed crops, W. M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 275–282*).—This is a reprint from Bulletin 40 of the station (E. S. R., 7, p. 116).

Experiments with potatoes, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 203–208*).—A reprint from Bulletin 39 of the station (E. S. R., 7, p. 122).

Potatoes, ancient and modern (*Jour. Hort., 1895, Oct. 31, pp. 405, 406*).—Report of a lecture by A. W. Sutton before the Royal Horticultural Society, giving critically the history and improvement of the vegetable.

The cost of a bushel of potatoes, C. E. CHAPMAN (*Rural New Yorker, 1895, Nov. 9, p. 742*).

Drilling rye, H. PETERSEN (*Landw. Wochenbl. Schles. Holst., 45 (1895) No. 42, pp. 579–581*).

Sachaline, C. E. BESSEY (*Amer. Nat., 29 (1895), No. 347, pp. 1007, 1008*).—The author reports adversely upon the introduction of this plant. His report is based upon two years' observations on its growth. Its foliage is said to be unfit for forage and no animal has shown a disposition to eat it.

On the culture of serradella, BARTELS (*Abs. in Fühling's landw. Ztg., 44 (1895), No. 14, pp. 443–448*).

Concerning culture experiments with Beta during 1894 and investigations on the wild form of the cultivated sorts, E. VON PROSKOWETZ (*Oesterr. Ungar. Ztschr. Zuckerind. und Landw., 1895, No. 2; abs. in Bot. Centbl., 63 (1895), No. 12, pp. 373–375*).

Influence of the size of the seed ball of sugar beets on their culture value, F. KUDELKA (*Ztschr. Böhmen, 19, p. 505; abs. in Ztschr. angew. Chem., 1895, No. 18, p. 550*).

Report of the agricultural station at Gembloux, A. PETERMANN (*Bul. Min. Agr., Belgium, 11 (1895), No. 1, pp. 1–8*).—Brief mention is made of fertilizer experiments on sugar beets, methods of seed testing, and publications of the station. It was concluded that the use of muriate of potash should be abandoned by those who sell sugar beets according to their sugar content. The elaboration of sugar was especially favored by phosphate of potash.

On the "underground" manuring of sugar beets (*Fühling's landw. Ztg., 44 (1895), No. 14, pp. 440–443*).—This is mainly a statement of the favorable effects obtained by Kühn at Halle in deeply preparing land for sugar beets and in incorporating the fertilizer in the lower portion of the surface soil. Incidentally the effects of this method of preparation and fertilization for small grains, potatoes, and leguminous plants are referred to.

Hairy vetch, sand vetch, or Russian vetch, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Circular 2, pp. 4, fig. 1*).—Brief notes on the time of sowing the crop, value of the crop as a soil renovator, and as food. "Hairy vetch withstands cold, heat, and drought, but it does not do well where there is an excess of water in the soil. It is one of the most promising fodder crops which has been brought into the United States in recent years."

The behavior of Vicia monantha, serradella, and lupine toward lime, C. FRUWIRTH (*Fühling's landw. Ztg., 44 (1895), No. 13, pp. 393–398*).

Wheat (*Minnesota Sta. Rpt. 1894, pp. 254–270*).—A reprint from Bulletin 40 of the station (E. S. R., 7, p. 118).

On the conservation of wheat, BALLAND (*Jour. Pharm. et Chim., 6 ser., 13 (1895), 11, No. 3, pp. 105–107*).

Experiments with some varieties of wheat treated with chemical fertilizers, E. ZACHAREWICZ (*Prog. Agr. et Vit., 12 (1895), No. 42, pp. 417–419*).

Time and depth of sowing wheat, oats, barley, and flax, W. M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 282–284*).—This is a reprint from Bulletin 40 of the station (E. S. R., 7, p. 119).

A note on some useful plants, E. A. FLOYER (*Note sur quelques plantes utiles. Cairo: Imprimerie Nationale, pp. 8*).—A list of Indian and Egyptian plants regarded as suitable for sandy soils.

Fertilizer experiments on a rotation of crops, J. G. LEE (*Louisiana Stas. Bul. 35, 2d ser., pp. 1211–1216*).—A continuation of work reported in Bulletin 29 of the station (E. S. R., 6, p. 513). Tabulated results are given of a 3-course rotation consisting of corn, oats and cowpeas, and cotton on fertilized and unfertilized land, for the 6 years 1889–'94. Fertilizers largely increased the yield of every crop.

Rotation of crops and field management, W. M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 284–288*).—This is a reprint from Bulletin 40 of the station (E. S. R., 7, p. 122).

Rotation of crops, Sir J. H. GILBERT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 22, pp. 172–230*).—An abstract of this article, taken from another source, has already been given (E. S. R., 6, p. 893).

HORTICULTURE.

Cherries, L. H. BAILEY and G. H. POWELL (*New York Cornell Sta. Bul. 98, pp. 383–412, pl. 1, figs. 11*).

Synopsis.—This bulletin deals with horticultural and botanical classifications of the cherry and includes illustrated descriptions of the more prominent varieties of the 2 classes, the sour and the sweet cherries. Cultural recommendations are also made.

Classification (pp. 383–386).—The author prefers to regard cultivated tree cherries as derived from but 2 species instead of the 13 admitted by some writers. These he cites as *Prunus cerasus*, the sour cherry, characterized by diffuse, low, round headed growth, suckering from the root, with flowers preceding the hard, stiff, abruptly pointed leaves, and producing roundish, red, sour fruit; and *Prunus avium*, the sweet cherry, having tall growing erect trees with bark tending to peel off in birch like rings, flowers appearing with the large limp, tapering leaves, and variously colored heart-shaped sweet fruit.

The sour cherries include 2 general types—the Amarelles, with pale-red fruit flattened at the ends and uncolored juice, comprising the Montmorency and Early Richmond; and the Morellos or Griottes, with dark-red spherical fruit and dark-colored juice, comprising the Morellos, Ostheim, and Louis Philippe.

The sweet cherries are represented by 4 types—the Mazzards, small inferior fruits of various shapes and colors; the Hearts or Geans, with soft fleshed fruit, comprising Governor Wood, Black Eagle, and Black Tartarian; the Bigarreaus, hard-fleshed, heart-shaped cherries of light color, comprising Windsor, Napoleon, and Yellow Spanish; and the Dukes, differing from the heart cherries mainly in their acid or sub-acid fruit, and comprising the May Duke, Reine Hortense, and Belle de Choisy.

A list is given showing the botanical synonymy of the classification adopted by the author.

Sour cherries in western New York (pp. 386–394).—It is stated that the growing of sour cherries in western New York is at present mostly confined to the varieties Montmorency and English Morello, Montmorency seemingly being preferred to the other. Its synonymy is discussed, and illustrated descriptions are given of several leading varieties of sour cherries. It is recommended that sour cherries be planted in a strong loamy soil retentive of moisture, and that the land be cultivated from early spring up to July, when catch crops should be sown for winter covering, to be turned under as soon as the ground is dry enough in the spring. Planting about 18 ft. apart is advised, the trees to be set out when 2 years old from the bud.

It is stated that insects and diseases are not serious upon the sour cherries, the chief damage being done by curculios, shot-hole fungus, and powdery mildew.

The sweet cherry industry (pp. 395–412).—It is the opinion of the author that the sweet cherries have not attained the prominence in the horticultural industry of the State that they deserve. A naturally dry, warm, deep, gravelly loam, with sufficient humus to retain the moisture and give lightness, is advised, and a high altitude for the orchard is recommended to avoid danger from late spring frosts and from the rot. It is urged that the trees be set 30 ft. apart, or 50 trees to the acre, to allow sufficient space for growth. Pruning to a low spreading head for the first 2 or 3 years is advised, as this method shades the trunk and large branches, thus avoiding cracking and splitting from the sun, and also permits the easier gathering of the fruit. Clean cultivation is insisted upon, and but little fertilizing will be required. Great care in picking the cherries is given as a requisite for perfect fruit and good market prices, the fruit to be picked with the stems on, and only the stems touched with the fingers. Some figures are given of the profit to be gained from a cherry orchard, in one case an acre of cherry trees 18 years old netting $380, while an acre of rye netted $8. As in the case of sour cherries, illustrated descriptions are given of several of the more valuable varieties. Brief mention is made of the fruit rot. Bordeaux mixture is recommended as treatment. The following epitome of the bulletin is made by the author:

"Cherry growing is one of the neglected industries of western New York. There are practically no bearing orchards of sweet cherries, and very few of sour cherries. The product is sold both in the open market and to canneries. In general, the factories afford the better market, although well-grown and nicely packed fruits, particularly of the sweet kinds, find a ready sale in the general market.

"Cherries like a loamy soil which is rich in mineral food. They should generally be given clean and frequent cultivation until the fruit is ripe, and after that the land may be put to rest with some cover crop. Stimulating or nitrogenous manures should be used cautiously. Sour cherries should be planted 18 to 20 ft. apart each way, and sweet cherries about 10 ft. farther. Cherries are pruned after the manner

of pruning plums and pears. Sweet cherries should be pruned to 3 to 5 main arms, and not to a central leader.

"The curculio is the worst enemy to sweet cherries, and it is sometimes serious upon the sour kinds. Jarring the trees is the most reliable procedure.

"The rot, due to a fungus, is particularly bad upon the early and soft-fleshed sweet cherries. Spray for it twice before the fruit is half grown, with Bordeaux mixture. Plant varieties least susceptible to the disease. Be expeditious in handling the crop.

"Cherries for the general market should be carefully handpicked, with the stems on, and they should be neatly packed in small packages. Cherries for the general market, particularly the sweet kinds, should be handled with as much care as strawberries are. The smallest packages are the most profitable for the best cherries.

"The most d serving sour cherries for western New York are Montmorency, English Morello, and Louis Philippe. The last is best in quality, but apparently is least productive. Of sweet cherries, the following are recommended for market: Windsor, Napoleon, Black Tartarian, Black Eagle, Mezel, Robert's Red Heart, Downer's Late Red. For home use, Black Tartarian, Governor Wood, Coe's Transparent, Belle d'Orleans, Downer's Late Red, Black Eagle, Knight's Early Black; Napoleon, Rockport, Robert's Red Heart, Yellow Spanish, Windsor; May Duke, Belle de Choisy."

Forcing house miscellanies, L. H. BAILEY and E. G. LODEMAN (*New York Cornell Bul. 96, pp. 296-337, figs. 10*).

Synopsis.—In this bulletin the authors have published 9 miscellaneous articles as follows: Remarks upon the heating of forcing houses, lettuce, celery under glass, cress in winter, forcing eggplants, winter peas, bees in greenhouses, methods of controlling greenhouse pests by fumigation, and treatment of carnation rust.

Remarks upon the heating of forcing houses (pp. 297-306).—This details extended investigations as to the relative value of steam and hot water in closed circuits for warming large forcing houses. Extensive tables are given of observations made with water in both low and high expansion tanks and with steam, the conclusion being reached that a more even and higher temperature can be maintained by means of steam than by the use of water for heating large forcing establishments which are frequently modified and extended and where the runs of pipe are devious and crooked. In the heating of water in closed circuits a high expansion tank was found to be more useful than a low one. The consumption of coal was found be practically the same in both systems. An experiment with warming a small private conservatory with water heated by illuminating gas was satisfactory except as regards the expense of the fuel.

Lettuce (pp. 307-314).—This article gives the more important points in the cultivation of lettuce under glass as derived from several years' experience. Solid earth beds are preferred to benches. The varieties Boston Market and Grand Rapids are regarded as leading for forcing purposes. From 7 to 10 weeks should be counted upon from the sowing of the seed to the delivery of the product. The time may be shortened 10 days or 2 weeks by using electric arc lights hung directly over the house, one lamp of 2,000 normal candlepower being sufficient for a house 20 by 75 ft.

The aphis is regarded as the most dangerous pest and should be prevented from gaining a foothold by fumigating the houses twice a week with tobacco.

In the words of the author, "the requisites for growing lettuce under glass are a low temperature, solid beds, or at least no bottom heat, a soil free of silt and clay but liberally supplied with sand, and careful attention to watering. Rot and leaf burn are prevented by a proper soil and temperature, and care in watering and ventilating."

Celery under glass (pp. 315, 316).—This is a brief description of the growing of celery for marketing in May and June when the supply of stored celery is exhausted. The seed is sown in late fall or early winter in flats and transplanted twice at monthly intervals in cool houses. For bleaching the plants surrounding the stems with hard, thick, sized wrapping paper was found to be best, employed first when the plants are from 3½ to 4 months old. The bleaching will be completed in from a month to 6 weeks. The variety Kalamazoo is regarded as well adapted to house cultivation.

Cress in winter (pp. 316, 317).—This is a very brief note, stating that water cress can be successfully grown in cool, moist places under benches in greenhouses, even without running or standing water.

Forcing eggplants (pp. 318–325).—Experiments with eggplants in greenhouses showed that they can be successfully grown under glass, the seed being sown in late summer and the young plants handled twice in pots before being set 2 ft. apart in rich soil in solid benches. Sandy loam has produced the best plants. It was found that they required a long time for maturing and that a high temperature and much sunlight were necessary. An abundance of nitrogen was required to prevent stunting. Hand pollination was necessary. The plants were found to be somewhat troubled by insects, particularly the 2 spotted mite, which was best treated by frequent applications of water to the foliage, thus preventing its gaining a foothold. The plants bloom in late December and early January and mature fruit in May. The variety Early Dwarf Purple is considered the best variety for forcing.

Winter peas (pp. 325–327).—Investigations in growing peas in forcing houses to determine their value as a commercial crop under glass have shown that the tall or half-dwarf varieties force readily in a cool house, yielding edible peas in 11 or 12 weeks from the time of sowing. The very dwarf varieties were found to yield too little to pay for their growing. Extra Early Market and Rural New Yorker gave satisfactory results.

Bees in greenhouses (pp. 327, 328).—This is a brief report on an experiment with wintering a hive of bees in a vegetable house filled with tomato plants. Not only did the bees not fertilize the flowers, but they made constant efforts to escape from the house, and were found to be useless as winter pollinators.

Methods of controlling greenhouse pests by fumigation (pp. 328–333).—As it is believed that when greenhouses are thoroughly infested with insects and fungus pests it is almost impossible to free the plants from them, it is advised that frequent fumigation of the houses be given

with various substances to prevent invasion by plant enemies. Directions for making tobacco smudges and fumigating with bisulphid of carbon, hydrocyanic acid gas, and sulphur are given.

Treatment of carnation rust (pp. 333–335).—Experiments to free diseased plants from this fungus resulted in the conclusion that the copper fungicides were most efficient. Both Bordeaux mixture and soap, and a mixture of bichlorid of copper, air-slacked lime, and soap were used, 2 applications being made.

Winter muskmelons, L. H. BAILEY (*New York Cornell Sta. Bul. 95, pp. 277–292, figs. 12*).

Synopsis.—This bulletin contains notes on investigations with the greenhouse forcing of melons in winter and directions for its pursuit, and brief mention of winter melons for field cultivation.

The forcing of melons (pp. 277–288).—The best results were obtained where the temperature of the house ranged from 80 to 85° at midday and about 10° lower at night. A fertile soil, rich in mineral elements and without an excess of nitrogen was best, and care was found to be necessary in regard to a dry atmosphere at the time of ripening, hand pollination, watchfulness in regard to insects and fungus attacks, and the selection of varieties specially adapted to forcing. A location where plenty of sunlight can be obtained is advised, with a space of several feet above the benches to permit of training the vines. The seed are sown in 2-inch pots, transferred in 3 weeks to 4-inch pots, and thence to the benches, about 4 sq. ft. of space being allowed to each plant. Strong bottom heat was found necessary. A soil composed of pulverized clay sod mixed with an equal part of old manure was found to produce good melons. During the growth of the plant, except at the time of flowering and ripening, a moist atmosphere was found best. Hand pollination was indispensable, the operation being performed on a sunny day in a dry house. The plants grew best when "stopped" before beginning to run, and 3 or 4 strong shoots trained upward on a wire trellis for about 4 ft.

The insects causing most trouble were the black aphis, 2-spotted mite, and mealy bug, the first of which was combated by fumigation with tobacco, the second by a moist atmosphere, and the third by washing off with a strong stream from a hose pipe. Where the plants were attacked by mildew, sulphur fumes proved best in destroying them. Canker or damping off was found to be best prevented by a dry soil about the plant, in which sulphur was mixed.

During the winter, from November on, it is stated that melons should weigh from 20 to 24 oz., each plant averaging 3 fruits. The best varieties for house use are Emerald Gem, Blenheim Orange, Hero of Lockinge, and Masterpiece, given in order of ripening. Blenheim Orange is believed to be the best. Illustrations are given of the fruit of several of the varieties.

Winter melons for field cultivation (pp. 288-292).—This class of melons is little known in this country and comprises melons of long season which, when planted in June, barely ripen their fruit before frost. It is stated that if they are picked before frost, while yet immature, and stored in a cool fruit room they will ripen slowly and often keep until Christmas. The varieties are lacking in scent and aroma, a defect balanced by their long-keeping qualities. The varieties Winter Climbing Nutmeg, White Antibes, and Winter Pineapple are recommended.

Squashes, L. C. CORBETT (*South Dakota Sta. Bul. 12, pp. 79-92, figs. 2*).—This is a popular bulletin on the subject of squash growing, dealing with planting, cultivating, pollination, insect enemies, and varieties. An experiment with planting seed of the Hubbard variety at depths of from 1 to 5 in. showed that a depth of 2 or 3 in., in hills below the general level of the soil, produced the best results. The planting should be done in South Dakota between May 5 and 15, the soil selected being rich and mellow and the hills being 8 ft. apart. It is suggested that not much barnyard manure be applied, as it is apt to render the soil porous and dry.

A plan for supplying both fertilizer and irrigation to squashes is briefly mentioned, large stones being laid in a circle 2 or 3 ft. in diameter, which space is filled up with barnyard manure. The squashes are planted just outside the circle of stones and occasionally during the summer water is poured upon the mound of manure, thus both irrigating and fertilizing the plants. Frequent cultivation is urged.

It is recommended that the striped cucumber beetle and squash bug be combated by means of mixing tobacco dust with the soil of the hill and afterwards mulching the young plant with the same substance. Descriptive notes are given for 13 varieties, of which Summer Crookneck is considered the best early variety. Pikes Peak and Boston Marrow have given the largest yields.

Raspberries, J. CRAIG (*Canada Central Exptl. Farm Bul. 22, pp. 28, figs. 10*).—A general, popular, and cultural bulletin, dealing with the history, cultivation, varieties, and diseases of raspberries. *Rubus idæus*, *R. occidentalis*, and *R. strigosus* are mentioned as furnishing the greatest number of cultivated varieties. For raspberries a cool, moist, loamy soil is recommended for the best results with the red kinds, although the black caps seem to do equally as well on sand and clay. It is advised that the plants be set out early in September in soil prepared by deep plowing and liberal manuring. The suckering varieties are said to grow best when planted 3 ft. apart in 6 ft. rows, while the black caps may be grown in hills 4 or 5 ft. apart. Keeping the canes cut back to a height of from 2 to 2½ ft. is recommended, the bearing wood to be removed as soon as it has done fruiting. Frequent shallow cultivation is advocated, occasionally varied by mulching with straw. The tenderer varieties should be grown either in long canes which may be bent down and covered in the autumn or trimmed short so as to be

protected by the snow. Heights of 5 to 6 ft. and 10 to 15 in., respectively, are recommended. If the tall canes are grown it is stated to be necessary to support them on trellises of some sort during the bearing season. Laying the canes down and covering them with earth during the winter is said to hasten the ripening of the fruit and increase production, except in the hardier varieties where no marked change was apparent.

Tabulated data are given showing the yields of 19 varieties in 1893. Heebner (red) and Pioneer (black) gave the largest yields. Descriptive notes are given for 51 varieties, several of which are illustrated. Illustrated, descriptive, and remedial notes are given for anthracnose (*Glœosporium venetum*) and orange rust (*Cæoma nitens*), spraying with Bordeaux mixture being recommended for anthracnose, and destroying diseased canes for orange rust. The following varieties are recommended for garden use: Brinckle Orange, Golden Queen, Heebner, Cuthbert, Older, Gregg, and Shaffer.

Irrigation for celery, L. B. PIERCE (*Cult. and Country Gent.*, 1895, Nov. 14, p. 820).—An account of celery growing on an irrigated swamp soil in Ohio.

Cultivation of cocoa (*Bul. Bot. Dept. Jamaica, n. ser.*, 2 (1895), No. 9, pp. 180, 181).

A pocket atlas of edible and poisonous mushrooms, etc., P. DUMÉE (*Petit atlas de poche des champignons comestibles et vénéneux, etc. Paris: Klincksieck, 1895, pp. XIX and 77, col. pls. 36*).

Experiments with tomatoes, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 213-217*).—A reprint from Bulletin 34 of the station (E. S. R., 7, p. 122).

Market gardening (*Jour. [British] Bd. Agr.*, 1 (1895), No. 3, pp. 287-291).—Statistics and other information on this industry in Great Britain

Saving vegetable seed, D. FAY (*Amer. Hort.*, 5 (1895) No. 11, p. 162)—Directions for the best methods of saving seed of several garden vegetables. Thorough maturity is advised.

Garden tillage, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 183-201, figs. 17*).—A reprint of Bulletin 38 of the station (E. S. R., 7, p. 35).

Trucking in the South, W. F. MASSEY (*North Carolina Sta. Bul. 112, pp. 70-95*).—This is a general and popular bulletin on the subject, especially adapted to the needs of North Carolina cultivators and dealing with the selection and preparation of soils for trucking, and the mixing and application of fertilizers for different soils and crops, with directions for seeding. The culture of the following vegetables is detailed at greater or less length: Asparagus, beans, Lima beans, beets, early and late cabbage, cauliflower, lettuce, cucumbers, celery, eggplants, kale, muskmelons, watermelons, onions, peas, Irish potatoes, sweet potatoes, radishes, spinach, tomatoes, and turnips.

In addition an appendix contains an article by H. B. Battle on fertilizers for different trucking crops, giving detailed directions and numerous tables showing the analyses of various vegetables as regards their fertilizing constituents and the proper fertilizing ingredients to be mixed and applied for the best growth. In addition to general rules special formulas are proposed for a number of vegetables.

Packing and handling apples, G. A. COCHRAN (*Amer. Hort.*, 5 (1895), No. 11, p. 163).—Brief recommendations, careful picking of perfect, well-developed fruit, and cold storage, being advised.

Bananas, E. LANGLASSÉ (*Rev. Hort.*, 67 (1895), No. 21, pp. 506, 507).—A brief article on their classification and culture.

Citrus fruits in Sicily (*Kew Bul. Misc. Inform.*, No. 106, pp. 266-271).—Statistics and methods of culture and marketing.

Good points in lemon culture, J. W. SCOTT (*Cal. Fruit Grower, 17* (*1895*), *No. 18, pp. 393, 394; reprint from the Covina Argus*).—Detailed cultural notes.

Essential oils of the orange (*Bul. Bot. Dept. Jamaica, n. ser., 2* (*1895*), *No. 9, pp. 177–180*).

Pears for home use, G. S. CONOVER (*Abs. in Cult. and Country Gent., 1895, Nov. 14, p. 821*).—Brief notes on the best varieties among 150 tested.

Plums, S. MILLER (*Amer. Hort., 5* (*1895*), *No. 11, p. 161*).—Brief mention of plum raising in Missouri, Wild Goose, Hawkeye, Golden Beauty, and Blue Damson being especially preferred.

Raspberries, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 26–229, fig. 1*).—A reprint from Bulletin 39 of the station (E. S. R., 7, p. 131).

The salmonberry, J. L. BUDD, F. W. CARD, and L. BURBANK (*Rural New Yorker, 1895, Nov. 16, p. 760, fig. 1*).

Strawberries, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 223–225*).—A reprint from Bulletin 39 of the station (E. S. R., 7, p. 131).

New varieties of strawberries, L. F. KINNEY (*Rhode Island Sta. Rpt. 1893, pp. 278, 279*).—Brief note on the varieties Lady Rusk and No. 21, which have proved to be superior berries at the station, the foliage being free from blight, and the fruit large and plentiful. Distributions of these varieties have been made to correspondents in different parts of the State.

Grecian currants, so called (*Cal. Fruit Grower, 17* (*1895*), *No. 18, p. 389, figs. 5*).—A brief illustrated article on "Zante currants," as the seedless raisins of Greece are called, showing the methods of their culture and giving statistics of their importation.

Chestnut grafting in New England, J. H. HALE (*Rural New Yorker, 1895, Nov. 9, p. 742*).—A record of a favorable experience in grafting Japanese varieties on native sorts. When grafting was done before the leaves developed about 20 to 25 per cent of the grafts succeeded; when done after the leaves were well developed about 75 per cent took.

Cultivation of the cocoanut (*Bul. Bot. Dept. Jamaica, n. ser., 2* (*1895*), *No. 9, pp. 182, 183*).

Violets, W. G. SALTFORD (*Amer. Gard., 16* (*1895*), *No. 46, p. 386*).—Cultural notes.

Crossing chrysanthemum flowers, G. W. OLIVER (*Amer. Gard., 16* (*1895*), *No. 50, p. 387, fig. 1*).—Detailed directions for this delicate procedure, it being necessary to cut away the disk florets and to shorten the rays.

Horticulture, W. C. STUBBS (*Louisiana Stas. Bul. ,2d ser., pp. 1209–1286, fig. 1*).—This comprises the results of variety testing at the three Louisiana stations during 1894 and consists of notes and tabulated data on the following: *Vegetables.*—Asparagus, bush beans, Lima and pole beans, beets, borage, brocoli, Brussels sprouts, cabbages, cauliflower, cardoon, corn salad, cress, chicory, chervil, sweet corn, cucumbers, eggplants, endive, kale, kohl rabi, lettuce, leeks, muskmelons, mustard, onions, okra, parsley, peas, peppers, pumpkins, radishes, roquette, potatoes, sweet potatoes, salsify, spinach, scarzonera, squash, turnips, and tomatoes. An illustration of the air tuber (*Dioscorea guatamala*) is included and the plant, which was accidentally found growing in a yard, bearing tubers in the axils of its leaves, is believed to be worthy of attempts for its amelioration. *Fruits.*—Pears, peaches, grapes, quinces, raspberries, figs, Japanese persimmons, strawberries, blackberries, dewberries, goumi, Japan wineberry, and oranges. Oranges were investigated as regards varieties, best height to top, manurial requirements, and best stock. The Satsumas and Kumquats are considered the hardiest sorts and *Citrus trifoliata* as the best stock on which to bud. The experiments with pruning and manuring were interrupted by killing frosts.

SEEDS—WEEDS.

Latent vitality in seed, I. GIGLIOLI (*Nature, 52 (1895), No. 1353, pp. 544, 545*).—In 1878 the author published a paper on the resistance of seed, especially alfalfa, to the action of gases and liquid chemical agents. Recently he has reëxamined portions of the seed left over from his experiments to see whether they have retained any of their vitality. The results are somewhat remarkable. In some cases a large portion of seeds have retained their vitality after a lapse of from 15 to 17 years.

The experiments conducted in keeping the seed in gases were made as follows: The seed were introduced into small bulbed tubes into which the gas was made to pass for a considerable time, after which the tubes were quickly sealed. Alfalfa seed kept in hydrogen failed to germinate. Wheat, vetch, and coriander also gave negative results. It is thought that probably the hydrogen was not originally well dried. Alfalfa seed kept in oxygen germinated 0.68 per cent, in nitrogen 56.56 per cent, in chlorin and hydrochloric acid gas 6.72 per cent, and in a second experiment with the same 5.98 per cent. In sulphureted hydrogen 0.99 per cent of alfalfa seed germinated, while of wheat none possessed vitality. In arseniureted hydrogen 70.98 per cent germinated in one case and 68.82 in another. In carbon monoxid 84.2 per cent germinated; in carbon dioxid all seed failed to develop, due probably to the large number of seed contained in a relatively small tube, rendering the gas damp and therefore noxious. In nitric oxid 0.97 per cent germinated in one case and 0.62 per cent in another.

Of the experiments made with keeping seed in liquids and solutions the only results given are those obtained with alcohol and alcoholic solutions, with the exception of one—chloroform—which rendered all seed completely lifeless. Seed which were originally placed in absolute alcohol germinated 66.6 per cent; in concentrated alcoholic solution of corrosive sublimate 20.2 per cent germinated. In alcoholic solution of sulphur dioxid 0.15 per cent germinated; in alcoholic solution of sulphureted hydrogen 7.03 per cent, and in alcoholic solution of nitric oxid 4.16 per cent. Seeds preserved in alcoholic solution of phenol showed no vitality.

Many of the alfalfa plants developed from seed used in these experiments were transplanted from the germinator into flower pots. The plants grew well, flowered, and seeded normally. The author states that it is probable that if in all these experiments special care had been taken at the beginning to exclude as much moisture as possible both from the seeds and the gases and liquids, a much larger proportion of the seeds would have retained their vitality. The difficulty of preserving the vitality of large seeds must be caused in all probability by failure to thoroughly dry them. The present researches have established the fact that for some seeds at least respiration or exchange with the surrounding medium is not necessary for the preservation of germ life.

The latent life of seeds, C. DE CANDOLLE (*Rev. Scient., ser. 4, 4 (1895), No. 11, pp. 321–326*).

The vitality of seed (*Roy. Bot. Gardens Trinidad, Misc. Bul., 2 (1895), No. 3, pp. 72, 73*).—Attention is called to the rapid deterioration of many kinds of seed in tropical climates. Instances are cited of 90 per cent germination in seed sowed as soon as gathered, falling to 50 per cent in a month, and nothing if kept for 3 months. Lettuce is said to lose its vitality within a few weeks.

On the germination of oil-bearing seed (concluded), LECLERC DU SABLON (*Rev. gén. Bot., 7 (1895), No. 71, pp. 258–269*).

Germination of nuts, T. H. HOSKINS (*Garden and Forest, 8 (1895), No 402, p. 448*).—The author reports the perfect germination of a lot of butternuts that had been stored in a shed loft for 4 or 5 years.

On the value of sprouted and then dried and musty seed for planting, C. RAMBOUSEK (*Landw. Wochenbl. Prag., 1895, No. 8, p. 73; abs. in Centbl. agr. Chem., 24 (1895), No. 6, pp. 393, 394*).

Frauds in seed and means for their prevention, E. SCHRIBAUX (*Prog. Agr. et Vit., 12 (1895), Nos. 40, pp. 369–372; 42, pp. 419, 420; 43, pp. 437–442*)

The value and production of pure seed, R. ROBER (*Landw. Centbl. Posen, 33 (1895), No. 33, pp. 195, 196*).

Results of analyses of agricultural seeds, G. CUGINI and F. TODARO (*Staz. Sper. Agr. Ital., 28 (1895), No. 6, pp. 322–340*).—Determinations of purity and germinating power of many species of forage and other plants were made.

Examination of seeds, L. F. KINNEY (*Rhode Island Sta. Rpt. 1894, p. 279*).—The author announces the equipment of the station with seed-testing apparatus, and states that the few preliminary tests made show that the per cent of germination was below the standard for the same seed in Europe, and that weed seed was present in some samples in very large quantity

Notes on the chemical history of Cuscuta, G. BARBEY (*Jour. Pharm. et Chim., 6 ser., 15 (1895), II, No. , pp. 107–112*).

California stinkweed, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 22, pp. 2, fig 1*).—A brief illustrated report is given of *Gilia squarrosa*.

Mexican poppy, Argemone mexicana, T W KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No 24, pp 2, fig 1*)—Illustrated notes are given of this weed, with suggestions for its eradication. In Australia this plant is said to be poisonous to stock

Tumble mustard, L. H. DEWEY (*Torrey Bul., 22 (1895), No. 8, p. 370*)—A brief note is given calling attention to *Sisymbrium altissimum*, which threatens to become a troublesome weed

Sachaline, [Polygonum] cuspidatum, and [P.] amplexicaule (*Rural New Yorker, 1895, Oct. 5, pp. 663, 664*).—Notes on the growth of these 3 knotweeds in New York State.

The Russian thistle, W M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 3–16, figs. 3*).—A reprint of Bulletin 33 of the station (E. S. R., 6, p. 301).

The Russian thistle, H. SNYDER (*Minnesota Sta. Rpt. 1894, pp. 31–36*).—A reprint of the chemical analyses of this weed as published in Bulletin 34 of the station (E. S. R., 6, p. 553).

Kansas weeds, I, A. S. HITCHCOCK and J. B. S. NORTON (*Kansas Sta. Bul. 50, pp. 19–54, pls. 9*).—This bulletin deals wholly with the seedlings of a number of Kansas weeds, and presents descriptions that will aid in determining the species of many of them. Illustrations are given showing the appearance and habit of 115 seedlings. The arrangement and botanical names are those found in the latest (sixth) edition of Gray's Manual. The common names are those most applicable and most widely known. Notes on seed distribution and descriptions of weed seeds are to follow.

DISEASES OF PLANTS.

Potato scab and its prevention, J. C. ARTHUR (*Indiana Sta. Bul. 56, pp. 69–80*).—The author gives a preliminary statement as to the discovery of the cause of potato scab and the means by which it may be prevented. The results of 3 seasons' trials with the corrosive sublimate treatment are given. The seed tubers were of the Burbank variety and were thoroughly covered with scab. The potatoes were of medium size, none being under 1½ oz. in weight, and were assorted so that the treated and untreated portions were strictly comparable. The tubers were immersed for different lengths of time, varying from ½ hour to 15 hours, in a solution of corrosive sublimate of a strength of 1 part to 1,000. When the potatoes were taken from the solution they were allowed to become nearly or quite dry on the surface and then planted, 1 uncut tuber in each hill. Alternate hills were planted with tubers in every way the same except untreated. A table is given showing the meteorological conditions for the growing seasons in the 3 years covered by the experiment.

The results of the 3 seasons' work, taken separately or collectively, were most satisfactory, and fully established the practical and efficient character of the treatment. The percentage of scab in the crop for the 3 years is tabulated, and the average shows that 82 per cent of the crop from treated seed was without scab, against 56 per cent from untreated. These crops were raised upon ground which had been devoted to potatoes for a number of years, and the percentage of tubers which showed a slight attack of scab was doubtless largely due to the organism remaining alive in the soil from the previous crops.

The author investigated the influence of the treatment upon germination and growth. All the experiments were conducted with seed tubers that had started to grow, although still solid and in good condition, and they probably represent an average quality of seed material as usually planted. The tabulated results of the 3 years' observations show that the treated portions came up slower and with fewer stalks per hill, indicating that the tender tissues in the eyes of the tubers had been somewhat injured by the poison. The time in which the tubers were immersed in the solution seemed to have no relation to the amount of injury done.

The influence of the treatment upon yield was also investigated. It was found that in all trials made the number of tubers per hill was less in the treated than in the untreated portion, probably due to the fact that there were fewer stalks per hill. However, the weight of merchantable tubers showed a decided increase in 1892 and 1894 due to the treatment, but a slight falling off in 1893. The author concludes that under the usual conditions of potato culture the corrosive sublimate treatment for scab may be expected to materially increase the merchantable crop.

Experiments were conducted on the effect of the cutting of tubers before treatment, in which it was clearly demonstrated that seed material may be treated after the tubers are cut, although it is likely to injure them to some extent. The larger the pieces and the shorter the duration of the bath the less the injury done. It is probably best to treat the tubers first and cut them afterwards. The strength of solution recommended is 1 part of corrosive sublimate to 1,000 parts of water; that is, 2 oz. of the corrosive sublimate to 15 gal. of water. The length of time of immersion varies somewhat with the amount of scab present, but it is found that 1 to 1½ hours is the most satisfactory length of time for ordinary practice. If, however, the tubers are somewhat sprouted and wilted a shorter immersion will be preferable, as in this condition the solution penetrates the tuber more rapidly throughout the whole surface, especially at the eyes, where there is considerable tender tissue that may be injured. In such cases a half hour will be found satisfactory. The cost of material for the treatment will not exceed 50 cts. per acre, and the extra labor and trouble are not considered serious obstacles.

Bordeaux mixture and potassium sulphid were tested at the station but with little success, and it was considered unnecessary to publish the data on these experiments.

On combating potato blight, A. SEMPOLOWSKI (*Ztschr. Pflanzenkrank*, 5 (*1895*), *No. 4, pp. 203, 204*).—A report is given of the use by the author of 2 per cent solutions of Bordeaux mixture and of a lime and iron sulphate mixture for the prevention of potato blight. Three plats were experimented on, the treated ones each receiving 2 applications of the fungicides. A slight decrease in the abundance of rotted tubers followed the use of the lime and iron sulphate mixture, while the Bordeaux mixture reduced the percentage of 15.5 on the untreated plat to 1.5 on the plat receiving it. The total yield, as well as the starch content, was increased by the use of the Bordeaux mixture, while in the case of the other fungicide there was a decided falling off in the total yield and only a slight increase in the starch content. The size of the tubers from the untreated plat averaged larger than those from either of the plats which were treated with the fungicides.

Grape diseases on the Pacific Coast, N. B. PIERCE (*U. S. Dept. Agr., Farmers' Bul. 30, pp. 14, figs. 3*).—The author popularly describes 3 of the principal diseases which affect the grape in California and other Pacific Coast States. The first one, called the California vine disease, has spread over a considerable territory, and it is estimated that it has destroyed 30,000 acres of vines, causing a direct or indirect loss of at least $20,000,000. This disease has been previously described in Bulletin 2 of the Division of Vegetable Pathology of this Department (E. S. R., 4, p. 498).

Some varieties of grapes are more resistant to this disease than others, but no variety has yet been found which can wholly withstand

its attacks. It has been ascertained that cuttings from diseased vines are themselves diseased; hence cuttings from vineyards known to be affected should not be employed in planting. It is stated that healthy cuttings may be with safety planted in vineyards where the disease has run its course.

The second disease described is the powdery mildew, more or less known throughout the country, but particularly troublesome in the region covered by this bulletin. For the preventive treatment of this disease the application of sulphur is recommended. In districts subject to the disease it is found desirable to apply the sulphur once before the grapes are in bloom and again when the fruit is set.

The third disease, to which the name coulure is given, refers to a condition in which there is a falling off of the grape flowers and the imperfect growth of the grapes. It is attributed to various causes and is a widely spread disease, although the greatest and most frequent losses occur in the raisin-growing districts of California and Arizona, and arise mostly from climatic causes. It has been found that the Malaga grape is practically free from this disease, and experiments are being conducted on crossing such varieties as the Muscat of Alexandria and the Malaga in the hope that a more resistant type may be secured.

Injury of leaves caused by a species of humblebee, A. YASUDA (*Bot. Mag. Tokyo, 9 (1895), pp. 291–307*).

A new lupine disease, FRANK (*Deut. landw. Presse, 22 (1895), No. 29, p. 215*).—The author describes a rust of lupines that was first noticed during the past year. It attacks the white and blue lupines, the yellow variety seeming to escape entirely.

Potato diseases, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 208–214, figs. 1*).—A reprint from Bulletin 39 of the station (E. S. R., 7, p. 136).

Some potato diseases and how to prevent them, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Farmers No. 25, pp. 6, figs. 4*).—Notes are given on *Macrosporium solani* and potato scab and suggestions offered for their treatment.

Report on disease in sugar cane, W. FAWCETT (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895), No. 8, pp. 165–167*).—The relation between the root disease due to *Colletotrichum falcatum* and the rind fungus *Trichosphæria sacchari* is stated and preventive measures suggested. For the prevention of nematodes deep plowing is recommended, the author stating that nematodes can not live more than 8 in. under ground.

Smut in wheat, W. M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 289–292*).—A reprint from Bulletin 40 of the station (E. S. R., 7, p. 140).

A new disease of wheat, A. SACCARDO and A. N. BERLESE (*Riv. pat. Veg., 4 (1895), No. 1–6, pp. 56–66, pls. 2*).—The disease is due to *Sphærodema damnosum*, a description of which is given. It appears to infest the bases of the sheaths surrounding the culms.

Apple tree sun scald, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 217–222, figs. 4*).—A reprint from Bulletin 39 of the station (E. S. R., 7, p. 136).

Cane rust or anthracnose of raspberries, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 230, 231, fig. 1*).—A reprint from Bulletin 39 of the station (E. S. R., 7, p. 137).

A grapevine fungus, Helicobasidium purpureum, G. BOYER (*Prog. Agr. et Vit., 12 (1895), No. 40, pp. 361–365, pl. 1*).

Cephaleuros coffeæ, a new parasite of coffee, F. A. F. C. WENT (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 18, 19, pp. 681–687, pl. 1*).

Nectria laurentiana, E. MARCHAL (*Rev. Mycol., 17 (1895), No. 68, pp. 155–158, figs. 3*).

Peronospora corollae, W. TRANZSCHEL (*Hedwigia, 34 (1895), No. 4, p. 214*).—The author describes a new species of rust which fruits on the corolla of *Campanula persicifolia*. The new species resembles *P. violacea*, although differing from it in the form of the conidia.

Culture experiments with Puccinia sylvatica upon Carex brizoides, G. WAGNER (*Hedwigia, 34 (1895), No. 5, pp. 228–231*).

Ustilago reiliana on corn, J. B. S. NORTON (*Bot. Gaz., 20 (1895), No. 10, p. 463*).—The author reports having found this smut on corn in Kansas during the present season. It attacks the whole plant, nearly destroying it, while the common smut is more local in its attack

The need of competent plant doctors, J W HARSHBERGER (*Education, 16 (1895), No. 3, pp. 140–141*).

Experiments in the treatment of chlorosis, J. M. GUILLON (*Prog. Agr. et Vit., 12 (1895), No. 42, pp. 408–411*)—The use of solutions of sulphate of iron, applied immediately after pruning, gave the best results Strengths of solutions of from 40 to 50 per cent are recommended.

An attempted curative treatment for white rot, L ABRIOUS (*Prog. Agr. et Vit., 12 (1895), No 40, pp 378, 379*).

Concerning the treatment against Peronospora, V PEGLION (*Riv. pat. Veg., 4 (1895), No. 1–6, pp 67–70*).

Lysol, its properties and its application, R FERRY (*Rev. Mycol., 17 (1895), No. 68, pp. 184, 185*).

The use of sulphate of iron and its effects, RASSIGUIER (*Prog. Agr. et Vit., 12 (1895), No 43, pp 431, 432*)—The successful use of an iron sulphate solution against chlorosis is mentioned.

ENTOMOLOGY.

Notes on scale insects in Arizona, J. W. TOUMEY (*Arizona Sta. Bul. 14, pp. 29–56, figs. 5*).—This consists of descriptive and life-history notes on the San José scale (*Aspidiotus perniciosus*), date palm scale (*Parlatoria victrix*), California red scale (*Aspidiotus aurantii*), California black scale (*Lecanium oleæ*), osage orange or frosted scale (*L. pruinosum*), and rose scale (*Aulacaspis rosæ*), with remarks on their distribution and ravages in Arizona and recommendations for remedies against them. Introductory notes are given on scale insects as a class and their treatment in general.

The San Jose scale at present in Arizona is confined to the Salt River Valley, where it was introduced on infested trees from California, none of the Arizona nurseries having been found to harbor the pest. The general belief that the intense dryness and heat of the summer months are sufficient to kill the scale is shown to be erroneous, although the heat undoubtedly checks the rapid progress of the scale. In the Salt River Valley the scale was found to be almost entirely confined to pear and apple trees, a few peach and apricot trees, however, being also infested. Whale oil soap wash is recommended as a remedy, applied strong, and possibly supplemented by fumigating with hydrocyanic-acid gas. It is advised that the wash be applied before the buds start in the spring.

The date palm scale was brought into Arizona in trees imported from Africa by this Department. The trees were then known to be infested,

but it was thought that all the scales had been killed. The species was then believed to be *Parlatoria zizyphus*, but it is now considered to be a new species—*P. victrix*. The trees infested are growing at the substation at Phœnix, where whale-oil soap wash was applied to them successfully after kerosene emulsion had been used with little effect. The scales are conspicuous against the dark green leaves of the palm, infesting both sides frequently in such numbers as to almost hide the surface, and resembling a dark scurfy deposit. The female scales are oblong, flat, and nearly black, with a white margin. It is believed that they spread very slowly. A ladybird (*Coccinella abdominalis*) was found feeding on the scale.

The red scale, black scale, osage orange scale, and rose scale have been found only scantily in Arizona, and it is not believed that they will be injurious, although recommendations are made for treatment against them. Five other species of scale insects found in Arizona, as yet of non-economic importance on account of their not infesting cultivated plants, are briefly described and noted.

There are appended technical descriptions of 6 new species of scale insects named and described by T. D. A. Cockerell, of the New Mexico Station.

Studies in artificial cultures of entomogenous fungi, R. H. PETTIT (*New York Cornell Sta. Bul. 97, pp. 339-378, pls. 11*).—The object of the present bulletin was to determine by means of cultures the life history and relationships of the forms of entomogenous fungi, as well as to make preliminary studies on the practicability of introducing diseases among insects. Most of the forms studied are members of the genus Isaria, and its perfect form Cordyceps. The others are species of the genus Sporotrichum.

The author used as a culture medium the ordinary agar peptone broth, except in one or two cases, where the organism would not grow on such a substance, and potato agar was employed. The method employed for the separation of the fungus is to tease apart a small portion of some host containing spores. Meanwhile 3 tubes of the agar are placed in water and heated until the agar is melted, after which they are cooled to about 43° C. and the spores and the pieces of the fungus are washed into the first tube and well shaken. A drop or two is now poured in tube No. 1 and shaken, and the process is repeated in tubes Nos. 2 and 3. In separating the spores of the fungi this method is preferred to that of dipping with a sterilized needle. The contents of each tube is now poured into a sterilized Petrie dish, and the hardening of the agar fixes the organism in position. Isolated growths or colonies will appear, and it is well to make studies of them, for if they grow together it will be impossible to isolate them. A small portion may now be removed on the point of a sterilized platinum needle and transported to a sterilized potato or other suitable medium, from which a pure culture is obtained.

The author made extensive studies of *Cordyceps clavulata*, *C. militaris*, *C. militaris* var., *C. melolonthæ*, *Isaria farinosa*, *I. tenuipes*, *I. anisopliæ americana* n. var., *I. anisopliæ*, *I. densa*, *I. vexans* n. sp., *Sporotrichum globuliferum*, and *S. minimum*. Detailed notes are given of the experiments for each species, and several illustrations from photographs are included.

The bulletin also contains an extensive bibliography of the subject of insect fungus parasites, titles of about 75 papers being given.

Apicultural calendar for November, A. MAUCHAN (*L'Apiculteur, 39 (1895), No. 11, pp. 436–438*).—Notes on the treatment to be given bees in this month.

Nasal bot in sheep; grub in the head (Oestrus ovis), J. A. GILRUTH (*New Zealand Dept. Agr., Leaflets for Farmers No. [illegible], pp. [illegible]*).

The chinch bug, O. LUGGER (*Minnesota Sta. Rpt. 1894, pp. 173–18[illegible], figs. 12*).—A reprint of Bulletin 37 of the station (E. S. R., 6, p. 1003).

The locust borer, C. W. J. (*Forest Leaves, [illegible] (1895), No. 5, pp. 78, 79, fig. 1*).—Popular descriptive and remedial notes on *Cyllene robiniæ*.

A new Coccid, T. D. A. COCKERELL (*Roy. Bot. Gardens Trinidad, Bul. Misc. Inform., 2 (1895), No. 4, pp. 85, 86*).—Technical description of *Aspidiotus hartii*, found on yam roots in Trinidad.

Insects in nutmegs (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895), No. 8, p. 168*).

The pimento and its insect foes (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895), No. 6, pp. 121–123*).

Injurious insects and fungi (*Jour. [British] Bd. Agr., 2 (1895), No. 2, pp. 162–182, figs. 6*).—Popular notes and preventive remedies are given for the damson mite, pea beetle, bread beetle, pine beetle, cucumber and turnip mildew, turnip fly or flea, and club root of cruciferous plants.

Insecticides for the potato beetle, S. B. GREEN (*Minnesota Sta. Rpt. 1894, pp. 211, 212*).—A reprint from Bulletin 39 of the station (E. S. R., 7, p. 136).

Remedies and preventives for insects and fungus pests, T. W. KIRK (*New Zealand Dept. Agr., Leaflets for Gardeners and Fruit Growers No. 10, pp. 8*).

Predaceous and parasitic enemies of aphides, H. C. A. VINE (*Internat. Jour. Micr. and Nat. Sci., ser. 3, 5 (1895), No. [illegible], pp. [illegible], pls. [illegible]*).

FOODS—ANIMAL PRODUCTION.

Practical cattle feeding, W. C. STUBBS and D. N. BARROW (*Louisiana Stas. Bul. 31, 2d ser., pp. 1170–1202*).

Synopsis.—An account of 2 feeding trials in fattening poor oxen on cotton-seed meal, cotton-seed hulls, and molasses. Incidentally, the effect of exposure and partial protection was observed. Profits were secured in each experiment sufficient to lead the authors to recommend the fattening of cattle for beef where the above feeding stuffs can be reasonably obtained.

A practical discussion is given of the principles of feeding, use of feeding standards, compounding of rations, etc., with suggested rations for fattening cattle, work animals, and milch cows. Two experiments are described in fattening cattle for beef.

The first experiment was with 6 animals, 5 very poor, old, work oxen, and 1 comparatively young animal, and lasted from January 22 to March 30, 1894. The food consisted of cotton-seed meal, cotton-seed hulls,

and molasses, all fed *ad libitum*. The animals were divided into 2 lots, one kept under shelter opening to the south, and protected from the weather, and the other lot exposed. The detailed daily record is given for each of the 6 animals. A summary for the 10 weeks is given below:

Trial in fattening oxen, 1894.

	Average weight at end of trial.	Total gain in weight.	Average gain per day.	Average food eaten per day.			Profit per lot.	Value of manure per lot.
				Cotton seed meal.	Cotton seed hulls.	Molasses.		
Exposed lot.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		
Number 1	1,042.8	160.9	2.3	6.7	27.1	2.5	......	......
Number 2	849.6	159.4	2.3	6.7	24.0	2.5	......	......
Number 3	909.2	145.2	2.1	6.7	24.2	2.5	......	......
Totals and averages	2,801.6	465.5	2.2	6.7	25.1	2.5	$84.04	$9.33
Protected lot:								
Number 4	1,772.4	218.4	3.2	6.7	24.3	2.5	......	......
Number 5	882.2	86.2	1.2	6.6	21.4	2.5	......	......
Number 6	828.8	152.8	2.2	6.7	21.5	2.5	......	......
Totals and averages	2,78[illegible].4	457.4	2.2	6.6	22.6	2.5	8[illegible].50	9.91

The animals were bought at 1¾ cts. and sold at 3 cts. per pound, live weight. The cotton-seed hulls cost $5 and the cotton seed meal $20 per ton and the molasses 12 cts. per gallon; the manure was valued at $2 per ton. There was a wide variation in the gain made by the animals in the protected lot, and the total gain made by this lot was practically the same as that made by the exposed lot. As a rule the weather was mild.

"The seventh week, which was attended with prolonged cold rains, gave a larger increase to the protected pen, and hence really shows the value of protection. The rest of the feeding was attended by excellent weather. During this rainy cold week the exposed animals lost 25.4 lbs. in weight and ate 598 lbs. of food. The protected animals ate 567 lbs. of food and gained 26.6 lbs. in weight, a difference of 52 lbs. of flesh and 31 lbs. of feed."

The experiment in 1895 was with 5 poor native oxen purchased in the surrounding country, and lasted from March 1 to April 24. Three animals were exposed and 2 protected. The feeding and general management of the trial was the same as in the previous year. Only a summary of the results is given.

The 3 exposed animals gained 656 lbs. and ate $16.63 worth of feed; and the 2 protected animals gained 426 lbs. and ate $12.09 worth of feed. The animals were bought at 1¾ cts. and sold 3 for 3¼ cts. and 2 for 3 cts. per pound. The cotton seed meal cost $14 and the hulls $5 per ton and the molasses $4 per barrel. The average profit per animal in the exposed lot was $10.75 and in the protected lot $9.84; or valuing the manure at $2 per ton the profit was $12.60 and $11.58, respectively.

"In the experiments given above it was found advantageous to add molasses to a mixture of meal and hulls to secure a better balanced ration. Four pounds per day,

however, seemed to be the maximum amount which could be fed with safety. Increasing this quantity invariably induced scours. The molasses used was common black centrifugals, and can be bought in the New Orleans market for 5 cts. per gallon. . . .

"With beef at the present prices, and the large number of available cattle all through the South which can be purchased at reasonable rates for fattening, it would seem advisable to recommend our planters and farmers to go into the business whenever cotton seed meal, hulls, and molasses can be delivered at reasonable rates for transportation. . . .

"Besides the profits from the sale of his fat cattle he would realize immense benefit from the large quantity of excellent manure which they would give him, and if properly applied to the farm would soon render the latter far more productive and profitable."

The feeding of animals for the production of meat, milk, and manure, and for the exercise of force, SIR J. H. GILBERT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 22, pp. 231–316, diag. 1*).—This is an account of the investigations on the feeding of animals carried on at Rothamsted, England, since 1847, accompanied by résumés of the work done elsewhere on different phases of the subject. The introduction gives a history of the subject with the views of Thaer, Boussingault, and Liebig.

"It was in 1847, after Boussingault had published his first table of the comparative nutritive value of different foods, founded on their percentage of nitrogen, and after Liebig had substantially indorsed Boussingault's conclusions on the point, that systematic feeding experiments were commenced at Rothamsted. In the arrangement of them, the settlement of the questions raised by the experiments and conclusions of Boussingault, and by the enunciation of the theoretical views of Liebig, was kept prominently in view."

The scope of the experiments at Rothamsted is shown by the general heads below, under which the work is reported and discussed.

Food consumed and increase produced (pp. 239–248).—The results of numerous experiments with sheep and pigs are cited. In those with sheep a number of different feeding stuffs were added to Swedish turnips, mangel wurzels, or clover chaff, the latter being fed *ad libitum*. The results are summarized showing the nitrogenous, non nitrogenous, and total organic material consumed per 100 lbs. live weight weekly and per 100 lbs. of gain in live weight. The results are believed to justify the conclusions of more than 40 years ago that—

"Taking food stuffs as they go, it is their supply of the digestible non-nitrogenous, that is, of the more specially respiratory and fat-forming constituents, rather than that of the nitrogenous or specially flesh forming ones, that regulates both the amount of food consumed by a given live weight of animal within a given time and the amount of increase in live weight produced."

A recalculation of the data on the basis of present knowledge is said to render the results even more emphatic.

In the experiments with pigs, rations with wide and narrow nutritive ratios were variously compared, a part of the ration always being fed *ad libitum;* "and as the *ad libitum* food always supplied much the

larger proportion of the total ration, the animals fixed their own consumption, according to the composition of the foods and to their own requirements, including those both for respiration and maintenance, and for increase." No data are given in the report, but the results are graphically shown in a diagram.

"The conclusion drawn from the results of the various experiments with pigs was that, in their case, as in that with sheep, it was the supplies in the food of the available non-nitrogenous, or total organic, constituents, rather than those of the available nitrogenous substance, that regulated the amount consumed, both by a given live weight within a given time, and to produce a given amount of increase."

Here again recalculation of the data only emphasized the conclusion.

"In conclusion, in regard to this branch of the subject, it must be considered established that, taking ordinary food stuffs as they go, neither the amount consumed in relation to a given live weight of the animal within a given time (which, of course, in the fattening animal covers the requirements for increase as well as for sustenance), nor the amount consumed to yield a given amount of increase in live weight (which covers the requirements for sustenance also) was at all in proportion to the amount of the nitrogenous constituents supplied. It is, on the other hand, obvious that the consumption, both for sustenance and for increase, was much more nearly in proportion to the amount of the digestible and available non nitrogenous constituents supplied, but that it was more nearly still regulated by the amount of the total digestible organic substance—nitrogenous and non nitrogenous together—which the foods supplied.

Composition of oxen, sheep, and pigs and of their increase while fattening (pp. 248–255).—Analyses are given of "a fat calf, a half fat ox, and a fat ox; a fat lamb, a store sheep, a half fat old sheep, a fat sheep, and an extra-fat sheep; a store pig, and a fat pig," the results being given in each case for the carcass, the offal, and the entire animal. The data are discussed in detail, showing the proportions of the animal consumed as human food, and bringing out the fact that "the entire bodies, even of store or lean animals, may contain more fat than nitrogenous compounds, while those of fattened animals may contain several times as much. That of the fat ox contained more than twice as much, that of the moderately fat sheep nearly three times, of the very fat sheep more than four times, and of the moderately fattened pig about four times as much fat as nitrogenous substance."

Estimates are made on the basis of the above analyses of the composition of the increase in fattening oxen, sheep, and pigs. According to these figures the increase in fattening oxen contains seldom more than 7 to 8 per cent of nitrogenous substance and seldom less than 60 and generally nearly 65 per cent of fat. In the case of oxen fattened very young the increase may contain about 10 per cent nitrogenous substance and 50 per cent fat. With sheep the increase usually contains less nitrogenous substance than with oxen and about 70 per cent of fat. The increase of pigs contains 6.5 to 7.5 per cent of nitrogenous substance and 65 to 70 per cent of fat. In the latter part of the period of fattening sheep and pigs the increase contains less nitrogen and more fat.

Applying this to the food consumption, the author sums up the relation as follows:

"The results relating to the chemical composition of the different animals, in different conditions as to age and maturity, have shown that even store animals may contain as much, or even more, of the non-nitrogenous substance (fat) than of nitrogenous substance, while the bodies of fattened animals may contain two, three, four, or even more times as much dry fat as dry nitrogenous matter. It has further been shown that the proportion of fat to nitrogenous substance in the increase in live weight of the fattening animal is much higher than in the entire bodies of the fattened animals. If, therefore, the non-nitrogenous substance of the increase (the fat) is derived from the non nitrogenous constituents of the food, the relatively large demand for such constituents for the production of fattening increase would seem to be amply accounted for.

"The important question arises, therefore, What are the sources in the food of the fat of the fattening animal? In other words, from what constituent or constituents in the food is the fat produced?"

Sources in the food of the fat produced in the animal body (pp. 255–282).—In 1842 Liebig announced his view that although fat might be formed from the protein of the food, its main source was the starch, sugar, and other carbohydrates of the food. Following this came the experiments at Rothamsted, involving between 100 and 500 animals, and mostly made from 1848 to 1853. These showed that much more fat was formed than could be accounted for by the fat in the food; and "it was considered that no doubt whatever could be entertained that much, if not the whole, of the fat formed in the bodies of the Herbivora fed for the production of meat was derived from the carbohydrates of the food."

"In fact, the experimentally determined relation of the non-nitrogenous and of the nitrogenous constituents of the food, respectively, to the amount of increase produced; the composition of fattening increase generally; the relatively greater tendency to grow in frame and to form flesh with highly nitrogenous food; the greater tendency to form fat with food comparatively rich in non-nitrogenous substances, and especially in carbohydrates; and common experience in feeding—all pointed in the same direction."

In 1865 Voit announced respiration experiments with dogs fed chiefly on flesh, which he believed showed that fat was produced from nitrogenous substances; and he argued further that albuminoids were a chief source of fat in the case of Herbivora. He and Pettenkofer maintained that in order to establish the production of fat from carbohydrates it must first be shown that the fat formed could not be accounted for by the albuminoids and fat of the food. Some of the results obtained at Rothamsted were then recalculated, and the results for pigs and sheep are presented in concise summaries in the present report. The data show the amounts of fat produced in the animal on the basis of analyses, the amounts of fat in the food, and the amounts which could be formed from the albuminoids of the food, assuming that 100 parts of digestible albuminoids may yield 51.4 parts of fat. The total fat obtainable from these two sources (food fat and albuminoids)

was insufficient to account for that produced in the body, the deficiency varying in amount quite widely.

"[Without going into details the data for pigs] is cumulative and decisive that at any rate a large proportion of the stored-up fat must have its source in other constituents than the fat and nitrogenous substance of the food; in other words, in the carbohydrates.

"[As to the data obtained with sheep], although the evidence of fat formation from the carbohydrates of the food is admittedly less direct in the case of sheep than in that of pigs, yet, when the foregoing results are carefully considered, with due regard to the facts which have been discussed, no doubt can be entertained that there was a considerable formation of fat from carbohydrates in both of the series of experiments with sheep. And when it is borne in mind that neither of these series of experiments was arranged for the purpose of elucidating this particular question, it must be admitted that the results are more definite and conclusive than might have been anticipated. Nor can there be any doubt that if experiments were made with oxen under suitable conditions they would yield equally conclusive evidence on the point. . . .

"It was maintained by Voit and others that to establish the formation of fat from the carbohydrates it must be experimentally shown that the fat deposited was in excess of that supplied by the food, plus that which could be derived from transformed albumin. But it is obvious that the mere fact that the food contained enough nitrogenous substance for the formation of all the fat that had been produced would of itself be no proof that that substance had been its source. It has been seen, however, that Voit's requirement was amply fulfilled in the Rothamsted experiments, both with pigs and with sheep; and hence it must be admitted to be proved that at any rate some of the stored-up fat must have had another source, which could only be the carbohydrates."

In conclusion, the author reiterates the deductions arrived at from the Rothamsted experiments in 1866, which have not been changed by the reconsideration of the data.

Food and milk production (pp. 282–290). The comparison between the amounts of nutrients contained per week in the milk of cows and in the increase of oxen is shown by the author in the following table:

Comparison of the constituents of food carried off in milk and in the fattening increase of oxen.

	Nitrogenous substance	Fat	Carbohydrates	Mineral matter	Total solid matter
In milk per week.	*Pounds*	*Pounds.*	*Pounds*	*Pounds.*	*Pounds.*
If 4 quarts per head per day	2.64	2.53	3.33	0.54	9.04
If 6 quarts per head per day	3.96	3.80	4.99	.81	13.56
If 8 quarts per head per day	5.28	5.06	6.66	1.08	18.08
If 10 quarts per head per day	6.60	6.33	8.32	1.35	22.60
If 12 quarts per head per day	7.92	7.59	9.99	1.62	27.12
If 14 quarts per head per day	9.24	8.86	11.65	1.89	31.64
If 16 quarts per head per day	10.56	10.12	13.32	2.16	36.16
If 18 quarts per head per day	11.88	11.39	14.98	2.43	40.68
If 20 quarts per head per day	13.20	12.65	16.65	2.70	45.20
In increase in live weight per week oxen					
If 10 pounds increase	.75	6.35	....	.15	7.25
If 15 pounds increase	1.13	9.53	....	.22	10.88

"From the foregoing comparison it is evident that the drain upon the food is very much greater for the production of milk than for that of meat. This is especially the case in the important item of nitrogenous substance, and if, as is frequently assumed, the butter fat of the milk is, at any rate largely, derived from the nitrogenous substance of the food."

The balance between the food nutrients in the ration of the Rothamsted herd and in the milk is shown in the table below:

Constituents consumed per 1,000 lbs. live weight per day for sustenance and for milk production, the Rothamsted herd of 30 cows, spring, 1884.

	Total dry substance	Digestible: Nitrogenous substance	Digestible: Non-nitrogenous substance (as starch)	Digestible: Total nitrogenous and non-nitrogenous substance
	Pounds	*Pounds*	*Pounds*	*Pounds*
Total nutrients in ration	19.92	2.64	11.71	[1]14.35
Required for sustenance		.57	7.40	7.97
Available for milk		2.07	4.31	6.38
In 23.3 pounds milk		.85	3.02	3.87
Excess in food		1.22	1.29	2.51
Wolff's standard	24.00	2.50	[2]12.50	15.40

[1] Albuminoid ratio 1:4.4. [2] Exclusive of 0.4 fat; albuminoid ratio 1:5.4.

"On the assumption that the expenditure of nitrogenous substance in the production of milk is only in the formation of the nitrogenous substances of the milk, there would appear to have been a considerable excess given in the food. But Wolff's estimate assumes no excess of supply and that the whole is utilized; the fact being that he supposes the butter fat of the milk to have been derived largely, if not wholly, from the albuminoids of the food.

"The evidence at command is, at any rate, not inconsistent with the supposition that a good deal of the fat of milk may have its source in the breaking up of albuminoids; but direct evidence on the point is still wanting. Assuming, however, that such change does take place, the amount of nitrogenous substance supplied to the Rothamsted cows would be less in excess of the direct requirement for milk production than the figures in the table would indicate—if indeed, in excess at all."

The author points out that the food requirements for maintenance are determined by feeding only sufficient food to maintain the animal without gain or loss in weight while at rest, whereas physiological considerations indicate that the expenditure, independently of loss or gain, will be the greater the more liberal the ration. This, it is believed, would account for a part at least of the apparent excess of food, and the question is asked whether or to what extent any excess was used in increase of live weight [which is not answered by the data given].

As to the effect on milk production of the season and its characteristic changes of food, the average of 6 years is given of the yield of milk per head in each month of the year by the Rothamsted herd; and,

using the monthly averages obtained by Vieth from over 14,000 analyses of milk in 1884, the amounts of milk constituents produced in each month are calculated.

"Exercising such care and reservation in regard to the numerous results of ourselves and others which are at command, it may be taken as clearly indicated that within certain limits high feeding, and especially high nitrogenous feeding, does increase both the yield and the richness of the milk. But it is evident that when high feeding is pushed beyond a comparatively limited range the tendency is to increase the weight of the animal; that is, to favor the development of the individual, rather than to enhance the activity of the functions connected with the reproductive system. . . .

"But there remains the important question whether the period of lactation is lengthened, or the yield of the higher yielding cows is maintained the longer, by an increased amount of food; or whether, on the other hand, the period of lactation or the yield of milk is reduced by the limitation of the supply of food? The point is, at any rate, deserving of careful experiment and observation.

"It may be observed that direct experiments at Rothamsted confirm the view arrived at by common experience, that roots, and especially mangels, have a favorable effect on the flow of milk. Further, the Rothamsted experiments have shown that a higher percentage of butter fat of other solids and of total solids was obtained with mangels than with silage as the succulent food. The yield of milk was, however, in a much greater degree increased by grazing than by any other change in the food, and with us, at any rate, the influence of roots comes next in order to that of grass, though far behind it in this respect. But with grazing, as has been shown, the percentage composition of the milk is considerably reduced, though owing to the greatly increased quantity yielded the amount of constituents removed in the milk while grazing may nevertheless be greater per head per day than under any other conditions.

"Lastly, it has been clearly illustrated how very much greater is the demand upon the food, especially for nitrogenous and for mineral constituents in the production of milk, than in that of fattening increase."

Food and manure (pp. 290–301).—This is a discussion of "the subject of feeding as a source of manure," with special reference to the nitrogen recovered in the manure. The question as to the exhalation of nitrogen or its compounds by the animal is considered and the literature bearing on this point reviewed.

"[The conclusion is reached that] the loss of combined nitrogen by gaseous emanations from the lungs and skin is, for all practical purposes, quantitatively immaterial. The sweat would seem to be a more important source of loss in animals submitted to much muscular exercise. But, even in their case, it does not seem to be large; while in that of the animals of the farm, fed for the production of meat or milk, it would presumably be much less material."

The results are then cited of experiments made to determine the relation between the nitrogen in the food and that voided in the solid and liquid excreta; *i. e.*, "whether or not there was any loss of nitrogen in the feeding of animals beyond that stored up in their increase." These experiments include a number made by the Rothamsted station on pigs, sheep, and cattle, besides a large number of experiments made in Germany and France with a variety of animals.

"[In the earlier experiments], with the exception of the turtle doves experimented upon by Boussingault, all the other results were obtained with the animals of the farm, and in all cases excepting those of the experiments at Rothamsted with

pigs and with sheep, and at Woburn with oxen, the animals were assumed to be fed on only sustenance rations, and no allowance was made in the calculations for any increase or loss in their weight In every case, excepting in the experiment with Henneberg's ox No. 2, and in the experiments at Rothamsted with pigs in 1862, the figures indicate a notable and in some a very considerable loss of nitrogen, which, assuming it to be not explained by storing up of nitrogen in the animal, or deficient evacuation, might be supposed to point to a probable loss by respiration or perspiration, or both "

Later it was pointed out how small an actual loss or gain in the determined nitrogen might make a great difference in the balance, and the necessity of greater care in certain details was urged. Other experiments were made in Germany.

"[Since the publication of the later results] there has been little doubt entertained that, not only in the case of Carnivora and Omnivora but also in that of Herbivora, and even of ruminants, practically the whole of the nitrogen of the food which does not contribute to animal increase or to milk reappears in the excrements "

The author refers briefly to his paper "On the valuation of unexhausted manures."[1]

"The calculations relate to the use of food for the production of fattening increase. It is assumed that, on the average, such increase will contain 8 per cent of nitrogenous substance, corresponding to 1.27 per cent of nitrogen in the increase According to the calculations it results that of the total nitrogen consumed in foods rich in that substance such as oil cakes and leguminous seeds there will generally be less than 5 per cent retained in the fattening increase in live weight In the case of the cereal grains, on the other hand which are much less rich in nitrogen, a much larger proportion of the total amount consumed will be retained in the increase, generally perhaps about 10 per cent of it Of the nitrogen in graminaceous straws a still higher proportion will probably be devoted to increase while roots will on the average lose by feeding perhaps only about 5 or 6 per cent of their nitrogen

Food and the exercise of force (pp. 301–313).—The author gives a résumé of the investigation and views on the relations between food and the exercise of force from the time of Liebig. Metabolism and respiration experiments with different kinds of animals are cited, including some investigations at Rothamsted; and finally examples are given of the rations fed to horses by tramway, omnibus, and cab companies in Paris and in the United Kingdom.

"Reviewing the whole of the results which have been adduced illustrating the characteristic food requirements for the exercise of force it may in the first place be observed that the evidence is cumulative and decisive, that, with normal feeding and with only moderate exercise, there is practically no increased demand for the nitrogenous constituents of food, while there is, on the other hand, an increased demand for the more specially respiratory constituents, largely in proportion to the amount of force exercised If, however, the labor is abnormally heavy—that is, if it be pushed to the point of dilapidation, as indicated by loss of weight—there will, in that case, be an increased elimination of nitrogen in the urine, resulting from the degradation of nitrogenous substance, and accordingly an increased demand for the nitrogenous constituents of food.

"Lastly, it is of interest to observe that where the subject has been the most carefully investigated the rations adopted for horses include scarcely any of the

[1] Jour Roy. Agl. Soc. England, 21 (1895), part 2.

more highly nitrogenous foods, such as leguminous seeds, but, in addition to hay and straw chaff, consist almost exclusively of the comparatively low in nitrogen cereal grains; and would, therefore, be characterized by containing a comparatively large amount of digestible non-nitrogenous constituents in proportion to the digestible nitrogenous substance of the food. It has, however, been found that in the case of old or overworked animals it is advantageous to supply a somewhat larger amount of the highly nitrogenous leguminous seeds. In fact, as we put it in 1852—

"'A somewhat concentrated supply of nitrogen does, however, in some cases seem to be required when the system is overtaxed; as, for instance, when day by day more labor is demanded of the animal body than it is competent without deterioration to keep up.'"

Summary of the feeding of animals (pp. 313–316).—This is a recapitulation of the views adduced from the work and discussion given in the preceding chapters of the section on feeding. The author claims to have demonstrated that the amount of food required for maintenance or for the production of a given amount of increase in a given time is dependent in a larger degree upon the amount of digestible non-nitrogenous constituents supplied than upon the nitrogenous. He supports this by the results of analyses of the carcasses of animals, which showed that store animals contained as much non-nitrogenous (fat) as nitrogenous substance, while fattened animals might contain 2, 3, 4, or more times as much fat as nitrogenous matter; hence, the increase of fattening animals must have a much larger proportion of non-nitrogenous than of nitrogenous matter. Furthermore, "the fat of the increase is in great part if not entirely derived from the non nitrogenous constituents of the food," while "only a small proportion of the nitrogenous compounds of the food consumed is finally stored up in the increase of the animal."

Again, in the exercise of force "there is a greatly increased expenditure of the non-nitrogenous constituents of food, but little, if any, of the nitrogenous."

"Thus, then, for maintenance, for increase, and for the exercise of force, the exigencies of the system are characterized more by the demand for the digestible non-nitrogenous or more especially respiratory and fat-forming constituents than by that for the nitrogenous or more especially flesh-forming ones. . . .

"In conclusion, as our current fattening food stuffs go, assuming of course that they are not abnormally low in the nitrogenous constituents, they are, as foods, more valuable in proportion to their richness in digestible and available non-nitrogenous than to that of their nitrogenous constituents. As, however, the manure of the animals of the farm is valuable largely in proportion to the nitrogen it contains, there is, so far, an advantage in giving a food somewhat rich in nitrogen provided it is in other respects a good one, and weight for weight not much more costly."

Buying and selling cows by tests of their milk, F. E. EMERY (*North Carolina Sta. Bul. 113, pp. 121, 122*).—A method is described of estimating the money value of a cow, when the daily yield of milk in pounds and the per cent of fat are known, by substituting in the following formula:

$$\text{Value} = \frac{\text{Pounds milk per day}}{8\frac{1}{2}} \times 12 + 4\ (\text{per cent fat} - 3.5).$$

"To buy or sell by this plan give or receive $12 per gallon of milk yielded per day that is rich enough to show 3.5 per cent fat. To this price per gallon add or subtract one dollar for every one-fourth of one per cent of fat above or below 3.5 per cent."

In 14 tabulated examples of the application of this formula the difference between values based on the yield at the beginning of lactation, and on the average for the whole period, was from 89 cts. to $12.17 in favor of the former.

Comparative profits derived from selling milk, butter, cream, and cheese, L. L. VAN SLYKE (*New York State Sta. Bul. 89, n. ser., pp. 153-166*).—The data for these calculations were furnished by Bulletins 77, 78, and 79 of the station (E. S. R., 7, pp. 45, 46, 47). The value of milk is based on the total solids at 9¼ cts. a pound, equivalent on an average to 2⅘ cts. per quart or 1.28 cts. per pound of milk; butter is valued at 25 cts. a pound; cream containing 20 per cent fat at 20 cts. a quart; and cheese 10 cts. a pound at 1 month old, equivalent to 9⅜ cts. a pound for green cheese. In calculating the profit only the cost of the food is used, and allowance is made for the food and fertilizing ingredients removed from the farm in milk and cream.

Tabulated data are given for 22 cows and 44 periods of lactation. The average profit per cow for a period of lactation is shown to be as follows: For milk, $19.80; for cream, $72.52; for butter, $25.64; and for cheese, $9.79.

The practical value of milk testing, F. E. EMERY (*North Carolina Sta. Bul. 113, pp. 123-127, fig. 1*).—The yields for 1 year of 2 three-year old cows are compared and the monthly yields of milk and fat are tabulated. The best cow gave 5,078.15 lbs. of milk, or 28.17 per cent more than the other, and 251.66 lbs. of butter fat, or 31 per cent more than the other. The author uses this difference in the yield of cows considered good to emphasize the value of milk testing.

Feeding experiments with laying hens (*New York State Sta. Bul. 90, n. ser., pp. 167-186*).—This is a comparison of rations containing moistened ground grain with others consisting entirely of dry whole grain. Four lots of pullets were used, 2 of White Leghorns and 2 of Buff Cochins. The 2 pens of Leghorns each contained 16 pullets at the start and the 2 pens of Cochins 9 each. The average date of hatching was June 15 for the Leghorns, and May 21 for the Cochins. The experiment commenced November 23 and continued 357 days.

Pens 1 and 3 received in the morning a mixture of ground grain moistened with hot water during cold weather and with ordinary water during hot weather; and later in the day some kind of whole grain or cracked corn. Pens 2 and 4 received whole grain of different kinds. In each case the dry grain was scattered in clean straw on tight floors to induce exercise. The nature of the feed is indicated by the following:

"The mixed grain fed to pens 1 and 3 was made to correspond closely to the combination of whole grain being fed at the same time to pens 2 and 4. With the exception of using wheat bran and middlings instead of ground wheat, the same grains

were fed ground in the mixture that were fed whole in the contrasted ration. The ground-grain mixture No. 1, fed until January 24, consisted of equal parts by weight of wheat bran, wheat middlings, corn meal, ground oats, and ground barley. The grain mixture No. 2, fed from January 24 to July 25, contained the same grains used in No. 1 with ground buckwheat added, equal parts of each. The mixture No. 3 consisted of 3 parts of ground flaxseed and 1 part each of wheat bran, wheat middlings, corn meal, ground oats, ground barley, and ground buckwheat. . . .

"The fowls in all the pens were fed twice each week all the cut bones they would eat. Skim milk was fed to all during part of the trial. Green alfalfa or corn silage or soaked, chopped hay was fed at noon, the moistened chopped hay being fed warm to pens 1 and 3. Plenty of limestone grit and oyster shells were kept always in each pen."

The composition of the mixtures and foods used is tabulated. The cost of the rations is based on the following average prices: Wheat 57.6 cts., corn 50.1 cts., oats 37.9 cts., barley 61.4 cts., buckwheat 56.1 cts. per bushel; wheat bran $16, middlings $17, corn meal $19.20, ground oats $24, ground barley $25.60, ground buckwheat $23.36, alfalfa hay $9.60, alfalfa forage $2, and corn silage $3 per ton.

The results for each lot are tabulated, showing the amount of each kind of food eaten, the nutrients in the same, the cost of food, and the eggs produced.

The summary follows:

Food eaten and eggs produced on dry and moistened grain.

Pen No.	Food	Breed	Eggs produced per fowl during year.		Average amount of water-free food eaten		Average cost of food		
			Number	Weight	Per fowl daily	Per pound of eggs laid	Per hen during year	Per pound of eggs laid	Per dozen eggs laid.
				Ounces	*Ounces*	*Pounds*	*Cents*	*Cents*	*Cents*
1	Grain ground and moistened	Leghorns	85.95	173.45	2.58	5.31	72.11	6.66	10.04
2	Whole grain	do	84.13	168.37	2.98	6.33	82.69	7.84	11.74
3	Grain ground and moistened	Cochins	59.61	114.60	3.28	10.22	91.85	12.82	18.48
4	Whole grain	do	80.32	155.60	3.70	8.47	105.06	10.70	15.70

The author's summary of the experiment is as follows:

"(1) Two lots of laying hens, of large and small breeds respectively, having their grain food only dry and whole, ate more food at greater cost per fowl and for the live weight than did 2 similar lots having about 37 per cent of their grain ground and moistened.

"(2) A pen of Leghorns, which had for the year 37 per cent of their food ground and moistened grain produced eggs at a greater profit than did an exactly similar pen fed whole grain.

"(3) Of two like pens of Cochins, the one fed whole grain produced eggs at much less cost than did the pen having ground grain, which result is attributed partly to the exercise assured in feeding whole grain.

"(4) With the kinds of whole grain ordinarily available it is not possible to feed a largely grain ration having as narrow a nutritive ratio, that is, containing as large a proportion of the nitrogenous food constituents as is perhaps necessary for best results from laying hens.

"(5) By using some of the highly nitrogenous by-products with ground grain it is possible to feed a somewhat narrow ration without feeding an excessive amount of meat.

"(6) With hens fed similar rations, when the hens of smaller breeds give only the same egg yield as the hens of larger breeds, the eggs are the more cheaply produced by the smaller hens; but taking into consideration the cost of raising and the ultimate poultry value of the hens, the profits will be equally or more favorable for the larger hens."

Digestibility of wheat, H. SNYDER (*Minnesota Sta. Rpt. 1894, pp. 146–148*).—This is a reprint from Bulletin 36 of the station (E. S. R., 6, p. 1009).

Studies on flour and bread, VIII, On the molding of bread, E. WELTE (*Arch. Hyg., 24, No. 1, pp. 84-108*).

Is it possible by means of the mechanical separation of the fat to obtain meat of fixed nutritive value? H. SIEIL (*Pflüger's Arch. Physiol., 61, No. 6, pp. 343–358*).

The quantitative determination of fat in animal organs, C. DORMEYER (*Pflüger's Arch. Physiol., 61, No. 6, pp. 341, 342*).—A preliminary notice.

Method of detecting ergot in flour and bread, M. GRUBER (*Arch. Hyg., 24, No. 3 and 4, pp. 228–253*).

Sugar as food for animals (*Milch Ztg., 4 (1895), No. 11, pp. 168, 169*).

The copper content of human food, K. B. LEHMANN (*Arch. Hyg., 24, No. 1, pp. 18–72*).

What amount of copper can be consumed in human food without being noticed? K. B. LEHMANN (*Arch. Hyg., 24, No. 1, pp. 72–83*).

The heat value of proteids in the organism, C. MATIGNON (*Bul. Soc. Chim. Paris, 11 (1894), 5, pp. 568–571; abs. in Jour. Chem. Soc., 68 (1895), II, p. 359*).

Miscellaneous analyses of feeding stuffs, H. SNYDER (*Minnesota Sta. Rpt. 1894, pp. 129–145*). This is a reprint from Bulletin 36 of the station (E. S. R., 6, p. 1008).

On the preparation of feeding stuffs, A. SCHMID (*Molk. Ztg., 9 (1895), No. 19, pp. 281, 282*).

Experiments in feeding molasses feed to cows, H. WEIGMANN (*Abs. in Milch Ztg., 24 (1895), No. 19, p. 303*).

Comparing prairie hay with timothy hay, T. L. HAECKER (*Minnesota Sta. Rpt. 1894, pp. 65–81*). This is a reprint from Bulletin 35 of the station (E. S. R., 6, p. 918).

Silage of flint, sweet, southern, and dent corn compared, W. M. HAYS (*Minnesota Sta. Rpt. 1894, pp. 208–215*).—This is a reprint from Bulletin 40 of the station (E. S. R., 7, p. 119).

Feeding of skim milk, E. POTT (*Oesterr. landw. Ztg.: abs. in Molk. Ztg., 9 (1895), No. 16, p. 230*).—The author advises against feeding skim milk to cows and states that it is best utilized when fed to growing calves. He gives directions for this.

Raising dairy bred calves, T. L. HAECKER (*Minnesota Sta. Rpt. 1894, pp. 82–92*).—This is a reprint from Bulletin 35 of the station (E. S. R., 6, p. 923).

Cost of butter production in winter, T. L. HAECKER (*Minnesota Sta. Rpt. 1894, pp. 57–64*).—This is a reprint from Bulletin 35 of the station (E. S. R., 6, p. 925).

Dairy herd record for 1893, T. L. HAECKER (*Minnesota Sta. Rpt. 1894, pp. 37–53*).—This is a reprint from Bulletin 35 of the station (E. S. R., 6, p. 928).

An example for American farmers and dairymen (*U. S. Dept. Agr., Section of Foreign Markets Circular 4, pp. 3*).—A reprint of an article on the dairy industry of Denmark.

The duck-fattening industry at Alesburg (*Jour. [British] Bd. Agr., 1 (1895), No. 3, pp. 281–283*).

Experiments with turkeys, S. CUSHMAN (*Rhode Island Sta. Rpt. 1893, pp. 280–310, pls. 7*).—An account is given of the work of the poultry division in breeding and raising turkeys, in continuation of Bulletin 25 of the station (E. S. R., 5, p. 505). The report is devoted almost entirely to the diseases of turkeys (see p. 426). In regard to the use of part-wild gobblers the following experience is given:

"Mr. Tucker, of Prudence Island, reared last season 300 turkeys from three-quarter-wild gobblers furnished by the station, and assures us that while these three-eighths-wild birds were not as tame, he was able to manage them all right, and that of those that hatched, more lived than of any other lot that he has ever had, and they were larger, more uniform in size, ate heartier, fattened quicker, and were plumper and handsomer when dressed."

VETERINARY SCIENCE AND PRACTICE.

A study of the diseases of turkeys, S. CUSHMAN (*Rhode Island Sta. Rpt. 1893, pp. 286-310, pls. 3*).—Slender tapeworms, from ¼ in. to 18 in. long, were found in turkeys. The life history of tapeworms, especially of 2 species occurring in sheep, and of gapeworms (*Syngamus trachealis*) are discussed.

Earthworms, containing in their bodies embryos of the gapeworm, are regarded as carriers of the disease. Hence, when the ground is infected with gapeworms it is recommended to saturate the soil with a strong solution of common salt, so as to destroy these carriers.

Various remedies for gapes are mentioned, among them being turpentine applied in the windpipe on the tip of a feather and asafetida, turpentine, or garlic given internally. Another method mentioned consists in causing the fowls to breathe in the dust of air-slacked lime falling from a muslin cloth above the coop.

Other topics treated are State control of contagious diseases among poultry, precautions against diseases, and Rhode Island Poultry Association.

DAIRYING.

Tests of dairy implements and practices, F. E. EMERY (*North Carolina Sta. Bul. 111, pp. 133-159, figs. 1*).—Four trials are reported in which the De Laval horizontal separator was compared with deep setting in water and in the air and with the Berrigan separator.

In the first trial, made April 6 to 9, inclusive, the morning's milk was divided into 3 portions, one part being set in deep cans in well water, another part in the air, and the third part treated with the Berrigan separator; and the evening's milk was run through the De Laval separator. About 15 lbs. of milk was set in each case and 40 lbs. run through the separator. The temperature of the well water used was about 60° F.; that of the air is not given. The tabulated results "seem to show, as far as the test was conducted, that the Berrigan [treatment] does not save as much as was claimed. Indeed from the results of the trial this machine was not as efficient as the common plan of deep setting in both air and water, and was much less efficient than the horizontal De Laval separator."

The second trial was made for 4 days, the last of April. In this the Berrigan treatment, setting in well water at 60° F., and the De Laval separator were compared. The cream obtained by each system was churned, and the butter worked and salted.

"The Berrigan treatment yielded 13.28 oz. of butter per 100 lbs. of milk more than the Cooley process as handled, and 5.76 oz. more per 100 lbs. of milk than the centrifugal separator. In our practice, however, the centrifugal process requires considerable less labor than the other methods.

"Since the Berrigan machine is no longer on the market, it is needless to remark that some of the claims for it do not seem to be substantiated by these trials."

The third trial was made in August and was a comparison of the Berrigan treatment, setting in shallow pans, setting in deep cans in well water without ice, and the De Laval separator. For 4 days the evening's milk was run through the separator and the morning's milk divided between the 3 other methods. The mean temperature of the dairy ranged from 76 to 78° F., and of the water in the Cooley creamer from 69 to 74° F.

"With all the care which could be given, such as sprinkling the floor and keeping doors closed, the temperature was too high for good results in creaming milk by any of the means tried except the centrifugal separator. . . .

"[Comparing the fat in the skim milk from shallow and deep setting] the percentages from the deep setting show least fat, notwithstanding the high temperature, except on the 2d, when some cream was accidently drawn down. The results with the deep setting at different hours compare favorably with the other methods, except the centrifugal, which shows a better result."

The results of churning the cream from different systems are tabulated.

In the fourth trial, made during the winter, the milk was separated for one week and the following week was set in deep cans in the Cooley creamer without ice. The data for the creaming and churning are tabulated. With the separator 527 lbs. 6 oz. of milk was used, giving 91 lbs. of cream, from which 30 lbs. 14 oz. of salted butter was obtained. With the deep setting 627 lbs. 11 oz. of butter gave 139 lbs. 3 oz. of cream, from which 29 lbs. 13 oz. of butter was obtained. The fat content of the skim milk from deep setting ranged from 0.4 to 1.6 per cent, while that of the separated skim milk ranged from 0.05 to 0.1 per cent.

"Comparing the average results from both systems, there is seen to have been a loss from the Cooley system of 14.29 per cent of the butter fat more than from the centrifugal system. Part of this may have been due to lack of that expert deftness in handling the Cooley creamer which the more thorough acquaintance from everyday work had given with the centrifugal machine. But it must also be remembered this test was chosen for the time of year most favorable to the gravity system in this climate; and when the comparison is made between the poorest result with the separator and the best with the gravity setting, there is yet about 8 per cent of the butter fat saved in the butter by use of the separator, and 1.16 per cent less loss from handling."

The financial result with butter at 25 cts. per pound is given for each method.

"The centrifugal result is based on 527⅜ lbs. of milk; the other on 627$\frac{11}{16}$ lbs.; total milk, 1,155 lbs. If all had been handled by the centrifugal separator at the same rate, the yield would have been $22.34. By the same proportion, if all had been handled on the submerged system, the yield would have been $19.36. The difference is $2.98 for the 2 weeks, using 82.5 lbs. or 9½ gal. of milk per day. This makes a cash

difference of 21.3 cts. per day on that amount of milk, or 2¼ cts. per gallon of milk in favor of the centrifugal system. . . .

"Thus, 10 cows, giving 2 gals. of milk each daily for 300 days per year, would show a difference in favor of the centrifugal separator of $135."

The results of a similar comparison of the separator and deep setting in well water at about 60° F. are given, together with the results of churning the cream.

"The 615.28 lbs., separated for the 2 churnings, yielded 29.286 lbs. of fat, of which 93.59 per cent was found in the cream, and from which 29.13 lbs. of butter were made after samples had been removed for all the tests.

"There were 382.906 lbs. of milk creamed in the Cooley creamer, using well water without ice. In this milk 17.756 lbs. of fat was found, of which 80.96 per cent was found in the cream, which made 15 lbs. of butter salted the same as the other had been. This was at the rate of 3.917 lbs. of butter for 100 lbs. of milk, whereas the yield from the separated milk was 4.735 lbs. per hundred of milk. The difference then is 0.818 lb. of butter, which at 25 cts. a pound, a fair price, amounts to 20.4 cts. on each 100 lbs. or 11⅝ gals. of milk. Results like these would add 1⅞ cts. (1.77 cts.) to the value of every gallon of milk from the use of the separator."

Trial of the U. S. Hand Separator No. 5 (pp. 153-155).—The results are given for 14 tests of this separator, using from 42 to 65 lbs. of milk. The fat content of the skim milk as determined by the Babcock test was at no time more than 0.05 per cent. The data for churning are tabulated.

Trial of the 10 gallon Victoria Hand Separator (pp. 156-159).—The results of 24 trials with this separator, using from 37 to 58 lbs. of milk, are tabulated, together with the results of churning. The percentage of fat in the skim milk as shown by the Babcock test ranged from a trace to 0.075, but was usually 0.025 per cent.

"With the U. S. Separator in 3 trials, there was an average of 11.3 per cent more butter made than there was fat in the milk handled. With the Victoria Separator, in the 3 trials in which no losses occurred, there was 13.5 per cent more butter made than there was fat in the milk handled."

Dairy bacteriology, H. W. CONN (*U. S. Dept. Agr., Office of Experiment Stations Bul. 25, pp. 40*).—This bulletin is supplementary to Bulletin 9 of the Office of Experiment Stations and covers the 3 years intervening since the publication of that bulletin. It gives a concise and systematic review of the investigation in dairy bacteriology. This is grouped under the 3 heads, bacteria in fresh milk, various types of fermentation, and relations of bacteriology to general dairying.

"The most important advances in dairy bacteriology in recent years have been in the application of our discoveries to practical dairying. In guiding the milk producer to his best methods of furnishing pure milk, in aiding the butter maker in obtaining a uniform and desirable flavor, and in helping the cheese maker to avoid some of his difficulties dairy bacteriology has already done much. In the immediate future we can see still further practical results, and can, in the light of our knowledge to-day, feel confident that within 10 years the discoveries in bacteriology will produce a complete revolution in almost every branch of the dairy industry."

The bacteriology of St. Petersburg milk, ZACHARBEKOW (*Wratsch., 1895, No. 13; abs. in Ztschr. Fleisch- und Milchhyg., 6, No. 1, p. 13*).—To test the market milk of St. Petersburg for pathogenic organisms, the author inoculated 80 guinea pigs each with 4 cc. of the milk. Fourteen, or 17.5 per cent, of the inoculated animals died, 4 from tuberculosis, 5 from peritonitis, and 1 each from infection with *Bacillus fœtidus, Diplococcus lanceolatus*, and *Bacillus mallei* (?)

Souring of milk and other changes in milk products (*U. S. Dept. Agr., Farmers' Bul. 29, pp. 23*).—This bulletin, prepared in the Office of Experiment Stations, is a revision of Farmers' Bulletin 9. It treats of the causes of milk fermentation; sources, number, and kinds of bacteria in milk; the souring and other fermentative changes in milk; and practical bearings of bacteriology on the handling of milk and on butter and cheese making.

The Babcock milk test, F. E. EMERY (*North Carolina Sta. Bul. 113, pp. 101-111, figs. 5*).—This is an illustrated popular article largely compiled. The test is described and directions given for its use with various dairy products, including cream, condensed milk, and cheese. The composite test, the coöperative or relative value plan of paying for milk, and the Russian pipette are also explained.

The detection of adulterations in milk, F. E. EMERY (*North Carolina Sta. Bul. 113, pp. 111-120*).—This is a reprint from Bulletin 31 of the Wisconsin Station (E. S. R., 4, p. 193).

Coöperative creameries, T. L. HAECKER (*Minnesota Sta. Rpt. 1894, pp. 93-103*).—This is a reprint from Bulletin 35 of the station (E. S. R., 6, p. 911).

Coöperative creameries in Denmark, J. H. MONRAD (*Cult. and Country Gent., 1895, Nov. 11, pp. 820, 826, fig. 1*).

Manufacture of sweet curd cheese, T. L. HAECKER (*Minnesota Sta. Rpt. 1894, pp. 104-128*).—This is a reprint from Bulletin 35 of the station (E. S. R., 6, p. 939).

AGRICULTURAL ENGINEERING.

Farm irrigation, A. A. MILLS (*Utah Sta. Bul. 39, pp. 1-72, figs. 13*).—The results of 5 years' investigation are summarized under the following heads: Amount of water to use and frequency of irrigation for wheat, timothy, and clover; surface and subirrigation, night and day irrigation, and fall and spring irrigation for wheat and timothy; early and usual irrigation for wheat and oats; furrow and common flooding irrigation for wheat and corn; number of times and when to irrigate wheat; early and late and usual irrigation for wheat; and methods of flooding for timothy. "Some of the matter has been published before [E. S. R., 6, p. 580], while a goodly portion of it has never been reported." The data are summarized in notes and tables, and charts are given showing in vertical section the character of the soil of the different plats used in the experiments. The following general summary is given:

"(1) On gravelly clay soil, 2 ft. of water were required to produce the best result with grain. Where the soil was more sandy $3\frac{1}{2}$ ft. were required. It is thought

that an average of 2 ft. will be required for most of the ground that is to be brought under irrigation in the future in Utah.

"(2) For wheat, clover, and timothy, it was found that the intervals between irrigations could vary from 6 to 15 days, favoring an interval of 12 days. If the interval was shortened to 3 days or lengthened to 18 days the results were quite disastrous.

"(3) With either fall or spring wheat the yield increased from 1 irrigation up to 3. The spring wheat decreased in yield when irrigated more than 3 times.

"(4) With either wheat or timothy, where either a cement tile or rock drain was used, subirrigation proved next to a complete failure, decreasing the yield of wheat by about 34 per cent.

"(5) Day irrigation gave better results than did night irrigation.

"(6) There was an increase of only about one-half bushel per acre for either early or for late irrigation over the usual time of irrigating.

"(7) There was an increase in the yield of timothy by irrigating in the fall, while the yield of wheat was slightly less from ground fall irrigated.

"(8) In distributing water we found that the systems which distribute it with the greatest evenness over the surface gave the best results. It appears that our common systems may be greatly improved.

"(9) We have found at this station that the yield of wheat, corn, and potatoes is decreased by the furrow system of irrigation as compared with the flooding system.

"(10) It is thought that much more of the ground that is irrigated at all in Utah is overirrigated than underirrigated.

"(11) The acre-foot, being a simple and definite unit, is recommended for general adoption for the division of water for agricultural purposes."

Orchard and vineyard irrigation, E. S. RICHMAN (*Utah Sta. Bul. 39, pp. 73-76*).—*Orchard irrigation.*—The subject of irrigating fruit orchards is briefly discussed, the question being considered whether irrigation may not be almost entirely dispensed with and reliance placed on the moisture stored in the soil during the winter months. It is believed that the best plan is to irrigate but few times during the season, at each irrigating, however, supplying more water than is usually done, sufficient, in fact, to reach to the deeper roots. The amount should vary according to the size of the trees, young trees requiring less water but more frequent applications, while after the third year it is believed that 2 or 3 irrigations during the season will be all that are necessary, about 15 in. of water being given to the plants altogether. A method used at the station for confining the water about the bases of the trees by means of planks and heaped-up earth is described. The common belief that water will injure trees by direct contact with the base of the trunk is considered erroneous. Thorough cultivation after each irrigation is insisted upon.

Vineyard irrigation.—This mentions an experiment comparing subirrigation *vs.* surface irrigation, and is largely quoted from the Annual Report of the station for 1893, p. 177 (E. S. R., 6, p. 580), the experiment having been continued since that time and the yield in 1894 being 18 per cent in favor of subirrigation. The experiment is being continued.

Silos and silage, C. S. PLUMB (*U. S. Dept. Agr., Farmers' Bul. 32, pp. 30, figs. 10*).—This is a popular bulletin prepared by the Office of Experiment Stations on the history and construction of silos, the production and storing of silage crops, and the

feeding of silage to farm stock. Round and square silos are described and figured and their cost given in detail. Indian corn, red clover, and sorghum are recommended for silage crops. The cost, composition, and feeding value of silage are given. From tabulated data it is shown that more digestible food per acre is secured from green fodder than from silage, and more from silage than from field-cured fodder. Silage is recommended for dairy and beef cattle and, with some limitations, for sheep.

Irrigation, R. H. McDowell (*Nevada Sta. Bul. 25, pp. 55, figs. 4*) —Information, compiled largely from publications of the Colorado and Wyoming stations, from the Report of the British Irrigation Commission of 1881, and from memorials to Congress adopted by the legislatures of Wyoming and Idaho, is given regarding different systems of irrigation, pumping and storage of water, and the measurement and division of water. The results of experiments with different numbers of irrigations on wheat and potatoes and with no irrigation on wheat and oats during 1892–'94 are briefly reported.

Measurement of water, A. M. Ryon (*Montana Sta. Bul. 6, pp. 149–170, figs. 6*).—Compiled information on the fertilizing value of irrigation water, the duty of water, the measurement of water for irrigation purposes, and devices for measuring and dividing water, with tables showing the discharge over rectangular and trapezoidal weirs.

Fruit and vegetable growing under irrigation, C. H. Longstreth (*Kansas State Bd. Agr. Rpt. 1895, Mar. 31, pp. 59–63*). A brief account of the methods used by the writer in irrigating a 60-acre orchard. Subirrigation by means of tiling is the method preferred.

Irrigation; with an example of its application in the arid regions of western America, A. B. Wyckoff (*Jour. Franklin Inst., 140 (1895), No. 4, pp. 241–262*).—This is largely statistical and deals especially with Tacoma County, Washington.

Irrigation farming, L. Wilcox (*New York: Orange Judd Co., 1895, pp. 313, figs. 95*).—This work contains chapters on the following subjects: History of irrigation; advantages of irrigation, relation of soils to irrigation; treatment of alkali; water supply; canal construction; reservoirs and ponds; pipes for irrigation purposes; flumes and their structure; duty and measurement of water; methods of applying water; irrigation of field crops; irrigation of the garden; irrigation for the orchard; the vineyard and small fruits; alfalfa; windmills and pumps; devices, appliances, and contrivances; subirrigation and subsoiling; common law of irrigation, and glossary of irrigation terms.

There is great need at the present time of a text-book explaining fully and accurately the principles and practice of irrigation. The present work in a measure supplies this need, but even a casual examination of it will show that many of the statements, especially in the earlier chapters, are vague, extravagant, often scientifically inaccurate, and in no part can the subject be said to be scientifically treated. The book contains, however, much useful information regarding practical methods.

Collection and storage of water in Kansas, E. C. Murphy (*Kansas Univ. Quart., 3 (1895), No. 4, pp. 217–224*).

Trials of hay and clover making machines at Darlington, England, C. W. Tindall (*Jour. Roy. Agl. Soc. England, 3d ser., 6 (1895), No. 23, pp. 476–483, figs. 3*).—Descriptions of several tedders.

Seed drills, Ringelmann (*Jour. Agr. Prat., 59 (1895), Nos. 32, pp. 189–191; 33, pp. 230–234; 34, pp. 265–271, figs. 29*).—The results of a test made in France.

A simple homemade corn harvester, J. Pearson (*Amer. Agr. (middle ed.), 1895, Aug. 24, p. 141, fig. 1*).

The use of the farm roller (*Fühling's landw. Ztg., 44 (1895), No. 12, pp. 387–389, figs. 7*).

A horseshoe for moor soils, Tacke (*Deut. landw. Presse, 22 (1895), No. 69, pp 625–627, figs. 3*).—A wooden shoe is described and figured.

A marked advance in the baling of cotton (*Tradesman, 1895, Oct. 1, pp. 55, 56, figs. 2*).—A compress for pressing the lint cotton directly from the gin into cylindrical bales is described in detail.

Miscellaneous implements exhibited at Darlington, England, C. MARSHALL (*Jour. Roy. Agr. Soc. England, 3d ser., 6 (1895), No. 23, pp. 460–475, figs. 9*).—Among the implements described are the Thistle milking machine, an overhead weighbridge for cattle, rotary potato digger, "speedy" churn, and a windmill with vertical axis for the sails.

Historical and technical papers on road building in the United States, R. STONE (*U. S. Dept. Agr., Office of Road Inquiry Bul. 17, pp. 52, figs. 7*).—This includes a Historical sketch of national road building in the United States, by Richmond Stone; Road building in Ohio, by M. Dodge; State roads in New Jersey, by E. G. Harrison; Macadamized roads, by C. E. Ashburner, jr.; Roads, by F. V. Green; and Road building in the United States, by Roy Stone. The bulletin is illustrated with pictures of a number of well constructed roads, including the Cumberland road and the Wooster pike.

Second annual report of the Good Roads Association of the Province of Ontario, 1894 (*pp. 94, figs. 4*).—Proceedings of the second convention of this association, including the text of various addresses and resolutions and of the following papers: "Good roads," by A. W. Campbell; "Road construction and maintenance," by W. M. Davis; "The statute labor law," by J. C. Judd; "Good roads," by A. F. Wood; "A few practical suggestions for the improvement and maintenance of the roads of Ontario," by P. K. Hyndman; "Historical roads," by A. Macdougall; and "Drainage laws applied to good roads," by —. Woods. There is also a tabular statement of township disbursements on roads and bridges in Ontario during 1893.

Notes on estate fences, W. MCCRACKEN (*Agl. Students' Gaz., 1895, July, pp. 127–136, figs. 15*).

STATISTICS.

Report of director of North Louisiana Station (*Louisiana Stas. Bul. 37, 2d ser., pp. 1207–1211*).—A brief review is given of the weather during the year, with remarks on the live stock at the station and on the establishment of a department of dairying in the station, and a record of the number of eggs laid by fowls of different breeds from March 1 to July 1, 1894. This is introductory to accounts of experiments at the station, abstracts of which may be found elsewhere in this number of the Record.

Annual Report of Minnesota Station for 1894 (*Minnesota Sta. Rpt. 1894, pp. 1–294*).—This includes a report on the organization and work, treasurer's report for the fiscal year ending June 30, 1894, and a reprint of Bulletins 33–40, which were issued during the year.

Index, 1888–'95 (*Massachusetts Hatch Station Index to All Bulletins and Annual Reports Published to Date, June, 1895, pp. 29*).

Reports of director and of treasurer of Rhode Island Station (*Rhode Island Sta. Rpt. 1893, pp. 161–177 and 319–321*).—A general review of the work of the year, a catalogue of the exhibit furnished by the station to the World's Fair, remarks on fertilizer inspection, the valuation of fertilizers, meteorology, and publications, and the treasurer's report for the fiscal year ending June 30, 1893. An appendix contains an index to the bulletins and annual report for the year.

Agricultural experiment stations: their object and work, A. C. TRUE (*U. S. Dept. Agr., Office of Experiment Stations Bul. 26, pp. 16*).—This is a brief summary of the objects, organization, and work of the agricultural experiment stations in the United States. Popular statements are given in regard to the methods of station work, the buildings and equipment, the extent of the station publications, ways in which the stations help the farmer, and the Office of Experiment Stations.

Proceedings of the eighth annual convention of the Association of American Agricultural Colleges and Experiment Stations (*U. S. Dept. Agr., Office of Experiment Stations Bul. 24, pp. 98*).—This is the proceedings of the convention held at Washington, D. C., November 13–15, 1894. In addition to the general business and

discussion the following papers are given: "The teaching of agriculture," W. T. Harris; "The attitude of the agricultural colleges toward university extension," E. B. Voorhees; "The coöperation of stations with farmers' organizations in experiment work," E. H. Jenkins; "The scientific work of the Department of Agriculture," C. W. Dabney, jr.; "The work of the experiment stations," A. C. True; "What is the mission of the bulletin?" H. H. Goodell; "What mechanical work shall be given to the students of our agricultural colleges?" W. E. Drake; "Faculty meetings," W. H. Scott; and "Entomological work in experiment stations," H. Osborn. A short account of this convention has already been given (E. S. R., 6, p. 257).

Organization lists of the agricultural experiment stations and institutions with courses in agriculture in the United States (*U. S. Dept. Agr., Office of Experiment Stations Bul. 23, pp. 88*).—This includes a list of the experiment stations in the United States, the governing boards and station staffs, a list of agricultural schools and colleges in the United States, with courses of study and boards of instruction, officers of the Association of American Agricultural Colleges and Experiment Stations, officers and reporters of the Association of Official Agricultural Chemists of the United States, list of station publications received during 1894, federal legislation affecting agricultural colleges and experiment stations, regulations of the Post-Office Department regarding experiment station publications, rulings of the Treasury Department as to the construction of the act of Congress establishing agricultural experiment stations, and an index of the names of college and station officers.

The world's markets for American products—Canada (*U. S. Dept. Agr., Section of Foreign Markets Bul. 4, pp. 67*).—Among the topics treated are statistics relative to area and population, agriculture, dairy interests, fisheries, forests, wealth, customs tariff, and commerce, and consular reports from 30 districts.

The world's markets for American products—Great Britain and Ireland (*U. S. Dept. Agr., Section of Foreign Markets Bul. 1, Sup., pp. 97-155*).—Reports from consuls at Liverpool, Hull, Glasgow, Leith, Belfast, and Dublin; and quotations from English sources on the agricultural conditions of the United States and the probable competition with British agriculture.

Monthly crop report, September, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 130, n. ser., pp. 24*).—Report on the condition of crops by States, report of European agent, and transportation rates.

Bulletins of the experiment stations (*Garden and Forest, 8 (1895), No. 400, p. 429*).—The author criticises the mechanical part of many station publications.

NOTES.

FLORIDA STATION.—M. S. Moreman has been employed by the station to investigate the injuries by frost to the orange groves of Florida and to report upon the best means of renovating the orchards. The station is extending its plantation of fruit and nut trees and vineyards at Lake City, DeFuniak Springs, and Fort Myers.

MAINE COLLEGE.—The L of the chemical laboratory of the college was recently destroyed by fire.

MARYLAND STATION.—In connection with the dairy experiments recently authorized by the board of trustees a creamery 21 by 40 ft. and a cow stable 30 by 40 ft. have been constructed. The creamery is to be supplied with a full equipment of dairy machinery, and the stable fitted with modern appliances.

NEBRASKA STATION.—C. L. Ingersoll, M. S., until recently director of this station, died December 8, 1895, at Grand Junction, Colorado.

NEW MEXICO STATION.—At the meeting of the board of regents December 9, A. Goss, chemist of the station and college, was elected vice-director of the station. During the first week in January the first farmers' institute for the State will be held at the college.

NEW YORK STATE STATION.—E. B. Voorhees, director of the New Jersey State Station, has been chosen director in place of P. Collier, and is expected to enter upon his duties early in February, 1896.

OKLAHOMA COLLEGE AND STATION.—J. C. Neal, professor of natural science in the college, and formerly director of the station, died December 22, 1895.

OREGON STATION.—A small dairy plant consisting of modern dairy apparatus has recently been added to the agricultural department of the station.

PENNSYLVANIA COLLEGE.—A temporary building containing 2 lecture rooms, seating 40 students each, a chemical laboratory, and a reading room, is in process of erection for the agricultural department of the college, with special reference to the accommodation of students in the short winter courses.

UTAH STATION.—The building designed for experimental work in dairying will be ready for use January 1, 1896.

PERSONAL MENTION.—Dr. H. Hellriegel, well known on account of his investigations on the nitrogen assimilations of legumes, died September 24, 1895, at Bernburg, Germany, at the age of 61 years.

Dr. M. Miyoshi has been chosen professor of botany of the University of Tokyo.

EXPERIMENT STATION RECORD.

VOL. VII. NO. 6.

In the development of the agricultural experiment stations in this country it was found almost necessary at the outset that they should engage quite largely in the dissemination of general information in various lines. In order that the farmers might understand the results of original investigations, and be able to apply them on their farms, it was necessary to explain in a somewhat systematic way what experience and research had previously ascertained. The technical terms, which in some cases it is essential to use even in popular accounts of station experiments, had to be defined; implements and processes with which the average farmer was unacquainted had to be described, and in general the agricultural public had to be brought up to date as regards their information concerning the results which practical and scientific inquiries in agriculture had attained. Moreover, the interest and sympathy of practical farmers had to be secured for the stations, which otherwise would not have been able to reach and benefit the individuals in whose service they were primarily working. The stations entered heartily into this work, and have diffused a vast amount of valuable information. There is no longer any reason why the farmer in this country should remain in ignorance of the teachings of the best experience and the most careful scientific research regarding his art. If he neglects to consider the important facts and principles set forth in the publications of this Department and of the experiment stations, he ought to blame nobody but himself when his more progressive neighbor outstrips him in the struggle for success. The thoroughness and liberality displayed by these institutions in their efforts to reach the farmers have excited the favorable comments of all foreign students of our agricultural affairs.

While we clearly recognize the necessity laid upon our stations hitherto to carry on this educational work and appreciate the value of the information which they have diffused, we nevertheless see that the devotion of so much time and energy to this task has necessarily restricted the original investigations of the stations, and in important respects has weakened the experimental inquiries which they have undertaken. It has also had a tendency to give the people a false

notion of the real purpose for which experiment stations were established, and has even led station officers to advocate plans of work which would either widen the scope of station work far beyond what was contemplated when they were established, or in the lack of adequate funds would reduce their original investigations to a minimum, and make the stations little more than bureaus of information or commissions for the enforcement of police regulations in matters pertaining to agriculture.

This tendency has been outwardly exhibited in a number of different ways. In its general aspect it has been illustrated in the proposition often set forth in the agricultural press, or in the written or spoken statements of station managers and workers, that the station is to do anything which may promote any agricultural industry. In a more limited and insidious way it has been shown in turning the college farm over to the station to run as a kind of "exhibition" farm, in conducting dairy schools or creameries in which a minimum of experimenting is combined with a maximum of instruction, in advertising patented implements or apparatus which it might be useful for the farmer to buy, in making extensive exhibits at fairs, in publishing addresses or proceedings of farmers' institutes, in aiding in the enforcement of State laws, in sending station officers to treat the diseases of animals, or to give personal advice to farmers regarding the best ways to conduct their farms.

Now, however useful some of these things may seem to be, and however justifiable to a certain extent as a means of stimulating the interest of farmers in the work of the stations, unless they are consciously regarded as mere makeshifts and are used as a means for expanding and strengthening the original investigations of the stations, they constitute a great peril to the ultimate success of the experiment station enterprise. Already in a number of places the stations have reached the "parting of the ways." Either the station must abandon very largely its functions as a bureau of information and education or it must allow its original investigations to be dwarfed and weakened. The severe and rigid conditions imposed upon the investigator in these days can not be made to conform to the requirements of multifarious duties in administration or instruction. There is a necessary specialization of effort in this as in other directions. The college president is no longer primarily a scholar; the teacher is likely to have too much work in instruction to be either a good executive officer or a successful investigator; the investigator may be a very poor instructor or administrator; the manager of farmers' institutes or county fairs may be valueless as an experiment station worker. The old saw about "jack of all trades and good at none" has a broader application than ever before. It may apply to an institution as well as to an individual.

The experiment station was established to make experiments. The closer it sticks to its "trade" the greater will be its success in the long run. It does well to refuse to do a great many things which might help

agriculture. The education of the farmer requires other agencies. Police duties relating to the protection of his interests against fraud or loss may wisely be committed to State bureaus organized for the purpose. If the experiment station will thoroughly bring to him such aid as experimental science, with its ever-widening range of operations can afford, it will perform the highest kind of service, and in the sequel will obtain the best reward in the confidence and esteem of intelligent practical men.

The introductory clause of the Hatch act has apparently misled many people more or less intimately associated with the experiment stations. The stations are undoubtedly "to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture," but this information is to be obtained by conducting original researches and verifying experiments, and the money from the National Treasury is given solely "for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results." It is very clear that this act did not contemplate that the stations would be general agents for the promotion of agriculture. Their operations were not to interfere in any way with the work of State boards or commissioners of agriculture. A large, distinct, and important field of work was plainly marked out for the stations in the organic act, and it will be well for the agriculture of the United States if they are kept within these limits.

SUGGESTIONS FOR INVESTIGATIONS IN VEGETABLE PHYSIOLOGY, WITH SPECIAL RELATION TO AGRICULTURE.

By Dr. GEORGE LINCOLN GOODALE,
Fisher Professor of Natural History and Director of the Botanic Garden, Harvard University.

It is thought that a brief synoptical review of some of the open questions in vegetable physiology which have a bearing on the cultivation of plants may assist our experiment stations in the prosecution of their useful work. The writer does not forget that some of our stations are incompletely, if at all, equipped for the investigation of the problems proposed, nor does he fail to realize that it would be poor economy if these problems were attacked by all the stations at once.

But it seems clear that the stations which may be provided with appliances in the department referred to can, by a judicious division of labor with their associates, carry forward to successful issue some of the questions in vegetable physiology which have a general and others which possess a deep local interest.

This division of labor is of importance. For example, while it would be a waste of energy for stations in our drier Southwest to busy themselves with inquiries which could be more naturally approached at the stations in the moister atmosphere of the Atlantic States, there are certain questions which properly belong to the former. Exactly how this assignment of queries and work should be effected it is no part of the present paper to suggest; the task at present in hand is merely to set forth in their proper relations and perspective the queries which ought to be solved satisfactorily and speedily and under the most favorable conditions for exhaustive inquiry. These questions can be better understood if we glance first at the plant as a whole.

Ordinary cultivated plants, the only ones we are to examine, are complicated machines for the reception of inorganic matter, which, under the influence of solar radiance, becomes transformed into organic matter. Vegetable physiology engages in the attempt to unravel the tangled skein of relations which exist between the first and last step of this series of activities.

Reduced to very simple terms, a plant, considered as a machine, consists of microscopic masses of living matter (protoplasm) inclosed in protecting walls of cellulose, through which run communicating threads of protoplasm of extreme tenuity by which, with few exceptions, all the separated masses are brought into a coördinated community.

This living matter, like the living matter of animals, requires food and oxygen; but just here comes in a difference which distinguishes plants from animals, namely, many plants, through the agency of chlorophyll granules embedded in their living matter, can, in the sunlight, make organic matter out of inorganic materials; and this organic substance is primarily the food which living matter of all kinds uses in its activities. In plants this organic matter is transformed into all the products of vegetation useful to itself and utilizable by man. To obtain this food and the various substances derived therefrom in plants in the best form and cheapest manner is the aim of the different processes of cultivation of the field, forest, and garden.

We are simply to examine the problems which concern the machine and its operations. Such problems are twofold, dependent on their general and special character. For the most part, the general questions can be most successfully attacked at some central point. But the special application of general results to local peculiarities belongs to the stations in the regions where they can be investigated under the best conditions. In our synoptical survey we shall point out both the general and special questions which seem most pressing at this time.

Our survey is to deal chiefly with the plants which have been under cultivation for a longer or a shorter period, and which have thereby acquired a certain sort of helplessness when left to themselves. Shortly after the fostering care of man is withdrawn from such plants changes are observed in many particulars, and this sensitiveness to modifications in the surroundings must be borne in mind by all experimenters. Although it is not always possible to draw any line of demarcation between different degrees of cultivation—for instance, in the case of our pasture and meadow grasses—the distinction which has been referred to should not be forgotten. While of course many, if not most, of the results of experiments on wild plants can be regarded as applicable to cultivated plants and vice versa, it will be safest in these present suggestions to keep in mind the fact that cultivated plants are specially under examination. The questions which are most important as concerns cultivated plants fall under two heads, namely, those which deal with the vegetative organs and those which have to do with reproduction.

VEGETATION.

The vegetative organs—the root, stem, and leaves—bring the individual plant into relations with its surroundings. Roots take from the soil the water and the relatively small amount of mineral salts needed; by the stem these are transported to the green tissue, chiefly of leaves,

where under the influence of light the water is combined with carbon appropriated from the carbon dioxid of the atmosphere, and thus is formed the primary product of photosynthesis. This undergoes changes fitting it for immediate use in the economy of the plant, or it is prepared for storing for future use. It would seem at first as if these three groups of organs must be equally under the control of the cultivator, but, as a matter of fact, it is only the roots which can be said to be under control in most of our plants grown out of doors. We can prune trees, grapevines, and the like, to gain special ends, or we can remove leaves from some of our herbaceous vegetation; but these modifications of stem, branches, and leaves are, after all, inconsiderable when compared with the control of the roots in practical cultivation. Considered from this point of view, the subject of roots involves a consideration of the soil in which they live and work. This fact must be borne in mind lest it be thought that in these suggestions an undue prominence has been given to the soil. It must not be forgotten that an examination of the physical and chemical relations of soils to cultivated plants involves the most vital questions of a practical nature in regard to vegetable physiology. Of course, in experiments on a comparatively small scale, and under glass, it is possible or even easy to modify the conditions of heat, light, and the amount of carbon dioxid within reach of plants; but, on even the humblest lot of ground devoted to open-air cultivation for the sake of profit, it is the soil alone which in the long run we can modify almost as we please.

Soil.—General considerations.—At first sight it would appear as if the only physical character of the soil of much importance in the cultivation of plants is its fitness to serve as a mechanical support to the roots, and to hold within easy reach of the absorbing organs certain indispensable inorganic materials.

Although such adaptability to adequate mechanical support is of prime importance, it is conjoined with certain features, likewise physical, which must be duly considered. There is not one of these features which may not fairly demand at the hands of our experiment stations a reinvestigation with special reference to local peculiarities. In fact, the excellent work done in this direction only emphasizes the necessity of more extensive local study.[1]

Among these features are to be particularly mentioned the following: (1) the degree of fineness of soil particles; (2) their dominant shape; (3) their relation to water and aqueous solution; (4) relations to the atmosphere; (5) relations to temperature. To some extent, of course, these

[1] In our country, work in this department by E. W. Hilgard and M. Whitney has been of the highest order. Their experiments indicate with clearness the direction in which further advance is possible under the limitations of station facilities. Excellent contributions have been made by many abroad, one of the most accessible restatements of the whole subject being by Wollny (E. S. R., 6, p. 761, etc.). A well-proportioned résumé is given also by F. H. King, in his treatise, "The Soil."

relations are correlated, and it is almost impossible to consider one set of them without taking into account the others.

The degree of fineness of soil.—There are many kinds of apparatus for ascertaining this, but none of them have fully satisfied the demands of investigators. The appliances fall naturally under two heads, according as they deal with dry soil or with soil in water. Both these sorts of sifting give good approximate results which answer for most practical purposes, and it is desirable that they should be, as far as possible, used in conjunction. The results of such mechanical analysis are surprising in two ways; they reveal enormous differences between soils which may appear on casual inspection to resemble one another closely, and secondly, they show how vast is the extent of surface of soil particles in the case of our finest soils.

The positive results which have been already obtained in our most western station and the comparison of the soils there studied with the soils examined by the same observer in the east show conclusively the importance of this special investigation.

A brief reference to some of the more recent statements regarding fineness of soils and its bearing on the activities within the ground will suffice to make the importance of the subject very clear. According to M. Whitney,[1] the approximate extent of the "surface area" of the grains in a cubic foot of the soil in the river terrace district of Maryland is over 100,000 square feet, and yet this soil has more than 50 per cent of empty space within the dimension stated. In 1 gm. of the subsoil of the river terrace, Dr. Whitney found approximately over 11,000,000,000 grains, while in the subsoil of the Trenton Limestone he estimates the number at more than twice this figure. From such results are drawn conclusions as to the best fineness of soils for certain crops, and thus the subject assumes the highest interest in its applications to vegetable physiology and to agriculture.

It is everywhere recognized that the degree of fineness has an important bearing on the solubility of substances, and this feature must therefore be taken into account when the availability of a soil is under consideration.[2] The relations of the degree of fineness of soil particles to the nature and intimacy of their contact[3] with the absorbing hairs on the younger parts of roots must be mentioned as increasing the importance of the subject from a practical point of view.

Obviously this question of fineness brings also into prominence the different means for pulverizing a soil and changing its character by different modes of tillage. There have been numerous experiments in

[1] Maryland Sta. Rpt., 1891 (E. S. R., 4, p. 17).

[2] The valuable investigation by W. B. and H. D. Rogers concerning the solvent action of waters indicates one of the best methods for the investigation of this subject.

[3] This is conveniently examined in seedlings of our cultivated plants and can be most satisfactorily studied under a lens of wide field and low power.

this department, but there ought to be many more of a similar character for purposes of wider comparison. If they are accurately conducted they can not fail to lead to more intelligent methods of cultivation in the localities whence the soils are taken.

There is another subject akin to that just reviewed, namely, the possible bearing of excessive fineness of the soil, and its consequent impenetrability to gases, upon the distribution of large trees in parts of our country. According to Prof. J. D. Whitney,[1] "the physical character of the soil of the prairies, and especially its exceeding fineness, is prejudicial to the growth of anything but a superficial vegetation, the smallness of the particles of the soil being an insuperable barrier to the necessary access of air to the roots of a deeply-rooted vegetation."

We have here a question in vegetable physiology of the widest possible interest, which is susceptible of experimental study at our prairie stations. As in a good many other instances, it is difficult wholly to lay aside all preconceived opinions and approach the investigation without prejudice. The explanation of the treelessness of the prairies, embodied in Professor Whitney's statement, seems, at the outset, inadequate to account for such a striking and widespread condition, but the more the explanation is examined in the laboratory, the more satisfactory does it appear. It can be better studied out of doors at the stations located in that area. Professor Whitney's interesting suggestion should stimulate experiments in the direction of ascertaining whether there are any trees better adapted than others to the peculiar soil conditions which there prevail.

It is well known to botanists that there is a wide difference between plants as regards the amount of oxygen needed by their roots, a difference illustrated by our aquatics, our species growing on the shore, and those which thrive only in loose, dry soil. Further, it has been experimentally demonstrated that in some species tolerance to a diminished supply of oxygen for the roots can be established early in the life of individual plants, and, in a few species, we have amphibious forms occurring spontaneously. In connection with this subject the whole matter of soil ventilation, which is well summarized by Professor King,[2] takes on a new significance.

Shape of soil particles.—It is rare to find the very minutest soil particles regularly spherical; they are mostly broken and irregular in form, and present under the microscope evidences of the most varied action of mechanical and other forces. If this irregularity is taken into account, it modifies to some extent the conclusions given as to area of soil particles in a given case, for such irregular fragments pack together in a manner quite different from what they would as spheres, and this changes, of course, their relations to water and to the air in the ground.

[1] The United States. By J. D. Whitney, 1889, p. 211.

[2] King's treatise, The Soil, p. 248, has some valuable suggestions regarding the ways of influencing soil ventilation.

Systematic microscopic observations of the dominant shapes of the particles in different localities would be a valuable addition to knowledge in this important field.

Relations of soil to water.—These present for investigation many physical and, indirectly, physiological questions which have been much studied in a general way. From the results of such observations it is now known that different soils differ most widely in their capacity to retain the water which comes upon them. Moreover, there are extremely wide differences in the kind and amount of movements of water in the different soils;[1] all these matters require in their bearing on cultivated plants to be reëxamined in different localities. The apparatus for such studies is simple and can be improvised from the usual stock in the chemical and physical storeroom. With even the simplest apparatus, results can be obtained which would throw much light on the important matters of irrigation and of drainage. Furthermore, experiments on a somewhat larger scale than is usual in a laboratory can be carried on at any of our stations under natural conditions which would be of immense value as object lessons to the farmers in the region concerned. It may be said in general that such field experiments may be of the greatest value in all our districts. When to this is added the series of experiments on the withdrawal by soil particles of matters dissolved in the liquids of the soil, the value of such observations must become apparent to everyone. The generalia are well understood and are accessible in numerous publications, but these should be supplemented at the earliest possible period by specific experiments in widely separated stations. The draft on time is comparatively slight, and it would many times repay for itself.

The recovery to fertility of extensive regions which need only water for their successful employment as arable lands is a problem of vast importance. The special conditions of water supply for irrigation are to be examined by engineers, but the equally pressing question[2] as to the fitness or unfitness of a given soil to receive and utilize the water brought upon it belong to the department of vegetable physiology.

A saline accumulation may go on under certain conditions to such an extent as to render vegetable life impossible, and it is therefore of prime necessity to ascertain the relation which possible drainage bears to the withdrawal of an excess of alkaline and earthy salts from the soil. In some cases at least such salts appear to be brought up to the surface by capillary progress of irrigation water which had reached some depth, as Hilgard has shown, and this accumulation at the surface becomes highly dangerous to the crops. Obviously this great danger is increased if the irrigation water which was supplied was originally loaded with a large amount of salts. The character of the

[1] The Soil, F. H. King, p. 154, and following chapter. Also M. Whitney, Relation of Soils to Crops, U. S. Weather Bureau Bul. 4, p. 90.

[2] In this important and contested field, the Government treatises and Whitney's United States, Supplement No. 1, Irrigation, should be carefully compared.

salts and their distribution in the soil must be examined in special cases, and further action must be based on an intelligent interpretation of results if success in the cultivation of crops on irrigated lands is to be looked for.

Relations of soil to gases.—The gases in the soil differ from the atmosphere above the surface, and the proportions of the admixtures there are constantly changing. Not only do the gases effect changes in the character of the soil, but they themselves may have their characters much modified by contact with it. It is everywhere known how speedily dry or even moderately moist soil will dispose of gases offensive to the sense of smell, and this remarkable power may be cited as an illustration of the class of relations now under consideration. When sewage flows over a receptive soil its character is immediately modified by contact. The offensive smell disappears, the composition is changed by withdrawal of certain substances from solution, and the residual water may escape almost free from solid matters. This extraordinary power of soils is utilized for the disposition of sewage on a large scale in the vicinity of a few cities, and has met with a fair degree of success as a sanitary measure. But it is more than this; it results in placing certain matters which are needed for the nutrition of plants in contact with the fine soil particles within reach of the root hairs and in a form easily available for appropriation.

To determine whether this process is not applicable in certain localities to small communities, or whether it may not be modified in some way so as to be more generally used, is a task which belongs on the one hand to boards of health[1] and on the other to our stations and their coadjutors. Coöperation in this task would certainly lead to useful changes in local treatment of the subject and check enormous waste. The degree of fineness, the composition, and the constitution of the special soil and its definite relations to water and to gases must all pass under consideration with respect to this important matter in any given case. No question in applied vegetable physiology is more pressing than this.

Soil temperatures.—By improved instruments of precision it is now possible to obtain more accurate results in regard to soil temperatures than at any previous period. The importance of trustworthy observations in this department, which so closely touches plant life, will be best appreciated by the consideration of the many relations which exist between the rate of growth of plants and the available heat of their environment. The warmth of the soil as a condition of plant growth is even more important than the heat of the atmosphere. It is, moreover, a question of the retention of heat by the soil, as well as its reception, which must be taken into account.[2] In general, the practical facts

[1] See the reports of the Massachusetts and other State Boards of Health.

[2] Compare Penhallow's Soil Temperatures, a series of researches at Houghton Farm, and see also a description of a new instrument for ascertaining soil temperatures, devised by Warren and Whipple, in Amer. Met. Jour., vol. 12, p. 35.

relative to this are well known and are fully accepted by all who have given attention to them; the application of these general principles to special cases would be much facilitated by intelligent observations in different localities. There are involved in such observations many complex questions of exposure, of the movements of water received and retained, and of the color of the soil, all of which are of importance and must be studied for each locality by investigators there.

Akin to this is the inquiry many times undertaken with varying success to ascertain the influence of plants upon the temperature of the soil on which they grow. This is especially important in the case of forests, owing to the part they play in the treasuring of water for steady instead of capricious supply.

Chemical relations of soil.—The development of the topic requires next the consideration of the chemical relations of soils. There is reason to believe that this subject has lost a great deal of its interest to vegetable physiologists since the introduction of the excellent methods of water culture. The results of experiments in water culture are so striking and so free from possible error by complication that they deservedly occupy a very high place among modern methods of inquiry.[1] But although the study of the action of chemicals upon soils and upon the plants which grow therein is far more difficult than researches as to solutions, it should be prosecuted as a special and practical matter in many localities.

The results of the remarkable researches at Rothamsted[2] are at the command of all our stations and indicate fully the direction in which supplementary researches in special districts could be undertaken with profit.

Much remains to be done in the investigation of special fertilizers, a subject which has been much studied in a careful manner by many of our stations. A large proportion of the work done in this department in the United States is of a high order, and shows beyond question that it can be still further prosecuted to advantage. Especially is this the case with regard to the collateral questions which have such a close connection with the profitable cultivation of crops, namely, the weathering of soils (more particularly the humus-bearing soils); the effect of mixing soils; the time, depth, and closeness of plowing; all of which by their mechanical and their indirect chemical results modify profoundly the relations of soils to crops. A careful investigation of the literature of the subject will reveal the necessity of additional local researches regarding all the above.

It appears as if experiments in regard to the ridiculous waste of manures now caused by placing them in many instances upon the

[1] In Detmer's Pflanzenphysiologische Praktikum; in MacDougal's and other experimental physiologies, explicit directions for this are given.

[2] See also the Lectures under the Lawes Agricultural Trust, and the remarkable reports from Rothamsted, covering a long period of time (Office Expt. Sta. Buls. 8 and 22).

ground at the wrong time might remedy an evil which, although most prevalent in the suburbs of northern cities, is not confined to them. It is a regular practice in some places to spread fertilizers on ground which is frozen hard. The first superficial thaw, especially if accompanied by rain, carries off an important part of the manure and it is irrecoverably lost. Such waste, in defiance of all laws of economy, might possibly be checked by the publication of authoritative results of careful experiments.

Akin to this general subject of manures stands the question as to the relations of microbes to the soil and to cultivated plants.[1]

The processes by which, through the agency of bacterial life, comparatively inert nitrogen compounds are transformed in the soil into active and available compounds are now fairly well understood, and this knowledge controls intelligent agriculture. There are, however, some minor matters connected with particular onditions which demand revision.

The subsequent loss of active nitrogen compounds by the curious reverse process known as denitrification is among the most important subjects. It must sooner or later engage the attention of investigators from the practical point of view, who will concern themselves with means for arresting the activity of the microbes by which useful matters are converted into useless ones. Few questions in any department of vegetable physiology present greater difficulties than those which involve the microbes assisting in nitrifying and denitrifying processes. To augment the beneficial activity of the one without increasing that of the other might appear to be almost hopeless.

Concerning the enormous importance of an allied subject, namely, the relations of bacteria to the free nitrogen in the soil, there can be no doubt. The earliest results in this department of investigation were not such as to encourage the attention of practical men. But since the detection of the curious symbiotic connection between certain bacteria and the life of Papilionaceæ, etc., the matter has taken on a new interest for all. It is now considered certain that, by means of this intimate relation existing between them, the latter are able to appropriate in considerable quantity the free nitrogen in the soil.

Exactly what the process is by which this appropriation is effected is as yet not fully understood; it is not positively known in what way the plant by means of its coadjutors is able to change inert free nitrogen into effective compounds for its own use. But that certain plants have this power is now beyond reasonable question. The inquiry as to the extent of this extraordinary faculty must be considered in each district for itself.

It happens that two of our plants present at the South particularly advantageous opportunities for settling some points in this matter.

[1] A large part of this work has been done in Germany and published in the stations records (Landw. Vers. Sta.). See Dehérain's account (E. S. R., 6, p. 353).

These plants, it is hardly necessary to say, are the varieties of the "cowpea" and the "peanut." Both of these have been examined in some of their relations with some degree of care, but much remains to be done.[1]

The examination, then, of these three groups of microbes, associated with the part which nitrogen plays in the soil, belongs to our experiment stations which are supplied with appliances for bacteriological research. The difficulties of the investigation can not be disguised, but these are more than equaled by the commanding importance of the inquiry in this department of vegetable physiology. The excellence of the results obtained already by Atwater and others in our country demonstrates that under the conditions of our stations great additions can be made to the knowledge of the subject.

It is more than probable that some of the unsolved questions regarding success in the rotation of crops may be connected with bacterial activity as intimately as with more obvious chemical activities. Bacterial inoculation of soils will assuredly assume great importance as soon as its possibilities become better known.

It may ultimately prove that the peculiar differences between certain contiguous soils in certain districts may be strictly dependent on the special microbes characteristic of them, and thus would be explained the impossibility of restoring, through the agency of fertilizers alone, to some kinds of exhausted soils, that which gave them their greatest value. It is understood that certain fields in Cuba which once yielded tobacco of the highest order of excellence do not now, even under skillful employment of fertilizers, produce the same type. The vigor of the plants is as great, and the weight of the crop as high, but it is said that the peculiar flavor is no longer procurable. It is difficult to believe that the difference in flavor can be wholly a matter of curing, since tobacco grown on the fields close by may possess the more desirable character. The question has many phases which it would be desirable to examine in the virgin and in the exhausted soils of our middle States.

The remaining questions relative to the vegetative organs of our cultivated plants concern themselves chiefly with the amount of water in plants at different periods of development; the rate and most favorable conditions of the production of organic matter; and its subsequent changes, all of which are intimately correlated with the activities previously spoken of. No one of these subjects can be well considered without the others.

The amount of water in different plants.—The determination of this is not difficult. Especially is this the case in those parts which are to be used in their comparatively dry state, such as timber and cabinet wood. But the importance of ascertaining this condition at different periods

[1] Compt. Rend., 117 (1893), No. 5, p. 298. Publications of the Tennessee and Louisiana Experiment Stations.

of growth or at different seasons of the year will be appreciated when it is remembered that the value and durability of wood is distinctly correlated with its condition at the time of felling. The amount of water contained in wood and the percentage of cells and condition of starch and other food materials in stems at different seasons might well be ascertained by all our stations. As in other cases, generalia can be applied, but it would be better to have different data obtained by specific and local studies. At present such data are exceedingly imperfect. This subject is obviously allied to the interesting one of harvesting.

The period of ripening of the seeds in the case of our cultivated plants is one of great chemical activity and extraordinary changes. Among the most remarkable of these changes is the withdrawal of water from certain parts preparatory to their complete or practically complete drying. This involves a good many curious problems regarding the plants in the succeeding generations which have a more or less important bearing on the time and the method of harvesting. Those familiar with the literature of the subject will concede that the matter needs a reëxamination in the different localities of our country where the stations are situated.

There is a kindred subject that should be mentioned on account of its probable bearing on the value of one of our most highly prized crops—namely, tobacco—and that is the change which takes place just after the harvesting of the leaf. The changes usually grouped under the name of fermentation have much to do with the development of the peculiar qualities which mark differences between the leaves from different localities. It has been suggested that these changes are accompanied by bacterial activity or dependent upon bacteria altogether, and that a knowledge of the special bacterial form involved in each case might throw light upon the differences recognized in trade, and this suggestion has led to good work on the subject. And though the results have not as yet been very encouraging, there is no reason for relinquishing the search for the cause of those differences.

It is also of great importance in connection with this subject to determine with more accuracy than heretofore the relations which exist between the character of the leaf and the fertilizers used in the cultivation. The differences are very subtle and in some cases are not developed till it is too late in the course of the experiment to make any changes in the conditions, so that investigations of this character are environed with perplexities and discouragements. But the striking results obtained at the Connecticut Station show how promising this outlook is. It is to be again and again enforced that while it may be possible to apply some of the general conclusions reached by the European experiment stations to our plants, it would be more satisfactory if our stations which are best adapted to the study of such questions would coöperate in this work and seek the advice of experts in special lines of inquiry.

Photosynthesis.—The chief work of green leaves is the preparation of organic matter from inorganic materials. The appropriation of carbon from the carbon dioxid of the atmosphere and its combination with the elements of water to form carbohydrates take place under conditions which are now well understood, although the exact method of synthesis is not yet fully made out. And, further, the dependence of the normal continuance of the synthesis on the presence of certain mineral salts, especially those of potassium, in the water furnished to the plant, is recognized.

Elaboration.—It is practically impossible to modify on a large scale any of the conditions under which the preparation of organic matter takes place, with the single exception of the soil and its contributions to the plant. On a small scale in the cultivation of one tropical plant, theobroma, the amount of light falling on the foliage is controlled by the cultivation of special shade trees or shrubs close at hand.

The organic matter produced by green tissue undergoes manifold changes. Many of these changes have been investigated and their conditions are fairly well understood. But there remain a few which need further investigation. Perhaps the most important of these is the relation which the area of foliage bears to the storing up of elaborated matters, the texture of certain parts, and the quality of the fruit.

The partial defoliation of certain plants during the period of decline in their activity has been advocated by some, and the results have been suggestive, but not as yet in complete agreement. Tobacco is a case in point. One experimenter has stated that plants having 6 leaves gave a larger leaf surface than those with a greater or less number. Another, in going over the same line of experimenting, has shown that the total yield with 14 leaves was the largest, and that these plants gave also the largest yield of high-grade tobacco. In almost all cases these modes of practice have given rise to somewhat discordant results, and there is a presumption that careful local experimenting would be highly useful.

The more general question may be profitably asked: Under what conditions can the percentage of useful products in any case be increased? In such a series of experiments each condition should be examined in turn and the results confirmed by studies designed expressly for control. Allied questions in vegetable physiology will suggest themselves to everyone who notices the variations in the character and amount of certain products of wild plants under different conditions. Of course, this whole matter is to be reached by the short cut of selection through the instrumentality of the seed, soon to be glanced at, but the subject of environment demands close reëxamination. As Sturtevant has shown,[1] some varieties of maize are singularly susceptible to changes in environment, almost any interference with normal conditions giving rise to modification in texture, number of rows, etc. Few fields of research are more inviting from a practical point of view.

[1] Sturtevant, Seed Breeding, Rpt. Conn. Bd. Agr., 1878, p. 149.

The studies here referred to may be extended almost indefinitely by taking up such problems as the possibility of increasing the strength of fibers, etc., by modifications in the feeding of the plants. The intimate relations which exist between the formation of cellulose and the employment of certain mineral matters indicate one of the lines of the possibilities.

REPRODUCTION.

The second great group of problems is concerned with the reproduction of our cultivated plants, and includes the weighty matters of selection and improvement. A brief glance at the established facts and accepted principles in this department of vegetable physiology will indicate the scope of the subject and make clear the limitations under which an experimenter is compelled to work.

First of all, attention must be called to the fact that even those plants which resemble each other most closely differ in certain particulars. The degrees of difference in these particulars give rise to the grades known as varieties, species, and the like. Between these grades there are no hard and fast lines to be drawn; such lines do not exist in nature. But for practical purposes it is very convenient to recognize the slightest or lowest grade of difference as characteristic of the variety. More marked differences are conveniently termed species; groups of species are called genera.

It must not be overlooked that the degrees of difference which separate certain species are not the same as those which separate other species. There is no regular fixed space or unit of distance separating species, nor is there any fixed space separating varieties. Some are closely approximate; others are widely separated. In many cases both of varieties or species the lines of separation which are imposed depend largely on the discrimination of the observer. Since judgments vary, the conventional limit of species and varieties must vary, too.

The fixity of the characters by which varieties and species are distinguished from each other bears a curious relation to the mode of perpetuation.

Plants are propagated either by means of buds or seeds (or, in the case of the lower plants, with which at present we have nothing to do, by means of the equivalent of buds and seeds). The essential difference between the results obtained in these two types of propagation may be stated in general, as follows: By buds, the individual peculiarities of varieties are perpetuable with little change; by seeds, variations are introduced. Like all general statements dealing with matters of organic activity, both these have exceptions which, although comparatively few in number, are of considerable importance. These exceptions can be best considered under each head.

The line of perpetuation by means of buds generally runs along for an indefinite period of time without any material modifications in the

structure, form, or properties peculiar to the stock. This uniformity is so nearly complete as to compel confidence on the part of the cultivators. The different modes of propagating by the agency of buds are regarded in practice as wholly trustworthy. Whether the bud or colony of buds is transferred to a congenial soil or to a stock which gives it welcome, there is developed a plant exactly like the parent from which the transfer was effected. Therefore the cutting, the layer, the bud, the scion, and similar fragments are depended on implicitly to carry forward and perpetuate, without noteworthy change, the desirable qualities which first brought the variety into deserved prominence.

In this way it is possible to continue the cultivation of a favorite variety of apple distinguished from all other varieties by its flavor, form, behavior with respect to cold, time of maturing, color when ripe, etc. The reasonable certainty of reproducing with exactitude all these characteristics is so great and has so few exceptions that the grafting of the scion on the stock is everywhere accepted as leading to assured results. The perpetuation of plants by means of buds has been so long in vogue in certain cultivated species that in process of time the power of producing fertile seeds has been lost, or is very infrequently observed. Bananas and pineapples are often cited as good tropical examples of this. Sugar cane is another case in point; others still might be mentioned, though less marked. The fixity of varietal characters in these instances referred to is occasionally interrupted by the unaccountable appearance of entirely new peculiarities.

Such sudden breaks in the continuity of succession are termed bud varieties. Attempts have been made to explain the unlooked-for occurrence of these variations or sports. To some investigators they appear to be reversions to an earlier ancestral character, and there are many reasons for taking this view. Others regard them as immediate reactions following some slight change in the environment. These two views, however, are not wholly inconsistent with each other, but neither throws much light on the very important question of how bud variations can be induced artificially.

It would obviously be a great gain if in any way we could foretell or, better still, produce bud variations in the case of the useful cultivated plants which are deficient in the development of seeds. Confining ourselves to the important case of the sugar cane, it may be said that a bud variety which should in a vigorous condition yield even a slightly larger percentage of sugar would be immediately recognized as of very great value to our cane growers.

The improvement of these seedless plants may be rendered possible in some cases by the method which has been applied to the sugar cane in some preliminary experiments. Investigation shows that the seedlessness of this plant is due to certain structural peculiarities which may be overcome in part by a fortunate union of the fertile pollen, which is occasionally met with, and the exceptional stigma which is receptive.

Such a quest demands great patience, for the cases are rare in which such a combination can be brought about.

Although with the means at present at command it is impossible to foretell the coming of a bud variety it is an easy matter to recognize it. For the present we must be content with this, and yet not relax the search for the causes of the variation. A few general facts should be kept steadily in mind in this search:

(1) That which has just been referred to, namely, the suddenness of the appearance of the variation; (2) the variation may affect the size and shape and the character of certain cell contents, thus causing changes in color, odor, etc.; (3) the variation may be a monstrosity; (4) it may, in polymorphic plants, consist chiefly in the persistence of the early forms; (5) it may affect only a limited part of the plant, for instance, a single branch or blossom.

When any bud variety of a desirable character has been detected, no pains should be spared to ascertain the antecedent changes in surroundings which may have contributed to its origination.

But the sorts of varieties which are most commonly met with are not those which occur suddenly in this unexplained way in the regular course of development or propagation of buds. The seed is a product of activities resident in different parts of a plant, or even in different plants. The essential difference between continuity in a definite line (as in the case of a bud and its derivatives, on the one hand) and the blending of two hitherto separated activities (as in the case of the pollen and ovule, on the other) probably underlie the recognized difference between nonvariation, or fixity, and variation. The seed introduces pronounced variation.

Therefore, of course, it is on the seed that culturists must depend for the origination of varieties. In general, in the case of plants of rather slow development, such as some of our fruit trees which do not come into profitable bearing for a number of years after germination, variation is reasonably sure to come in from seed.

Seeds from the Baldwin apple, for instance, do not give rise to plants producing that variety; seeds from the Bartlett do not yield Bartlett pears. It is a perfectly familiar fact that from seeds of such plants one may obtain possibly better varieties than the original type, but the chances are overwhelmingly against this.

As a rule the derivatives from plants of long cycle are less desirable in almost every way; nevertheless among the exceptions to this are some veritable prizes. Later we must ask whether it is possible to increase the ratio of favorable chances in such cases. But attention must now be called to a certain degree of fixity which exists in the characters of some plants of short cycle, such as certain annuals, and perennials which soon produce seed, such as the peach and a few others.

In these well-known cases varietal peculiarities may come true by way of seed. The catalogues of seedsmen are filled with names of

relatively permanent varieties. Such varieties are sold in the reasonable confidence that they will not vary further, or at least will not vary in undesirable directions.

By continual care in the exclusion of pollen not its own a relatively fixed variety may remain practically unchanged, but the intervention of pollen from even closely allied varieties may by blending introduce slight changes. It is believed that such cross-fertilization is the safeguard which nature throws around a species to prevent tendencies from becoming too pronounced in any unfavorable direction. Cross-fertilization secures or tends to secure an average product fitted to cope with the existing surroundings, whereas on the other hand by continued selection and close-fertilization it is possible for the cultivator to lead varieties along a particular line of development, and even go so far as to render such a plant incapable of competing in the struggle for existence. The withdrawal of the care of man would force such a plant, as soon as it is neglected, to fall back on reserve characters, which, however essential they may be for its own welfare in competition with its fellows, are very likely to be undesirable when considered from an economic point of view.

Innumerable experiments, now covering a very long period of time, show that successful crosses may be effected between plants which are not very far removed from each other in affinity. It was formerly the fashion of some to say that crosses could not be brought about between species belonging to different genera, but even allowing for the wide discrepancies of opinion as regards the limits of genera it appears to be settled that the statement requires qualification. To crosses between species the term hybrid is applied, but this has been used with considerable looseness, so that it has covered also certain crosses of well-marked varieties. The literature of the subject, now very voluminous, is filled with illustrations of the difficulty of foretelling what the result of any given cross will be.

First of all, and rather likely, there may be no result at all. The transfer of pollen from a stamen of a plant of the species A to the stigma of a plant of the species B may be followed by no ripening of seed, but it is barely possible that if the process had been reversed and the pollen from B had been placed on A, there might have been a distinct impregnation. In many cases it is absolutely impossible to predict the issue.

Owing to the multiplication of modern experiments, there are some indications now recognized as useful in certain cases, so that the chances seem to be improving that, before long, a more careful examination of pollen and stigma may show what subjects are unfit for crossing.

But if impregnation follows pollination, there is no certainty as to the product of the cross. The resultant of the cross may be (1) an equal blending of the characters of both parents, or (2) one may dis-

tinctly predominate, or (3) new peculiarities may appear, or (4) some of the seeds in the seed vessel may show one group of characters and others another group. In short, there may be a very wide range of characters in the product.[1]

It generally, but by no means always, happens that the vegetative vigor of a hybrid is somewhat greater than that of either of the parents, while the reproductive activity may be greatly diminished. Roots, stems, branches, and leaves may be larger and more active than those of the parents, and may be more resistant to untoward influences. On the other hand, the diminution in reproductive vigor may be so marked as to amount to sterility. But the degrees of augmented vigor and the degrees of sterility are so very various that no general rule can be laid down. There are some curious relations which exist between certain partially sterile hybrids and their parents which ought to be mentioned at this point, namely, that in a few instances which have been carefully examined, the pollen of one parent or of both parents may be potent on the stigma of the hybrid, whereas the pollen of the hybrid itself may have no efficiency at all.

Hybrids between different species may themselves be crossed with the parent species or with allied forms, giving rise to hybrids of other ranks or orders. In all these cases there is a marked tendency to vary, and this may be so pronounced as to carry the resultant hybrid far from the characters of its parents. The establishment of such a tendency to vary is an unequivocal gain in cultivation, because from that point the act of selection is rewarded with fruitful results.

In the skillful crossing of species and the initiation of variations greater than those usually attending the production of seeds normally is to be found one of the most attractive and remunerative fields of research for our experiment stations. Each locality where a station is established has the opportunity of endeavoring to meet the wants of its section by the selection of varieties specially adapted to it. The details of pollination and of subsequent care have been so well stated by many judicious authors that failure in experiments, if the directions are faithfully followed, may fairly be attributed to remarkable caprices of plants which are not as yet fully understood.[2]

It is perfectly possible by utilizing all the means at command to breed plants to points. If the desired aim is fully understood and the explicit directions relative to cross and close fertilization are obeyed, success must follow. That the discouragements are many can not be denied; but the rewards are likewise many. It would be well for each station to see next in what directions such experiments may profitably

[1] Plant Breeding, L. H. Bailey, New York, 1895. Nägeli, Sitzungsber. der kgl.-bayer. Akad. Wissensch. München, 1865, II. Focke, Pflanzen-Mischlinge, 1881.

[2] Pollination of Pear Flowers, M. B. Waite, U. S. Dept. Agr., Div. of Veg. Path. Bul. 5. Maximowicz, St. Petersb. Bul. Acad. Sci., 1872, XVII, col. 275.

lead at the present time. Each station can be its own best judge of the immediate wants of its particular district.

This subject is intimately bound up with the introduction of new plants to meet local wants. A single illustration will show how wide is the range open for experiment in this field of vegetable physiology.

There are large arid districts in our country which are not readily available for irrigation. But it is perhaps possible to utilize some of these tracts by the employment of plants suitable for pasturage which are natives of the driest soils. There are many species in the drier parts of Australia which serve as food for flocks in periods of protracted drought. It is difficult to say in what manner plants of those species are able to obtain from the parched earth even the small amount of water which they require, but they appear to thrive fairly well. It is a well-known fact that many organisms thrive better when they are carried to new homes beyond the sea. The dominance of our imported weeds shows sufficiently how vigorous are plants which find themselves under new skies, in a soil and with conditions tolerably near those of their former habitat. In two remarkable instances the rapid growth of such intruders has called for government interference, namely, the so-called Canada thistle and the Russian thistle which have come to us from the Old World. In Australia, on the other hand, the weeds from Europe have been thistles other than the one mentioned and the sweetbrier. These and the true star-thistle have proved troublesome pests there wherever they have gone. The history of these plants shows that the greatest caution should be exercised in the introduction of new plants lest we bring in thereby a host of troubles.

It would appear to be the part of prudence to experiment carefully with some of the plants which are peculiar to the drier parts of Australia and other semiarid countries and see whether it would not be desirable to introduce some of them into our desert regions. Such plants are sufficiently accessible for our stations here willing to make the trial. The experiment certainly promises well, but it must be hedged about with every precaution lest unwelcome species and the most vexatious kind are brought in.

In strong antithesis to this group of plants stand those which, having a very large amount of leaf surface for evaporation or having peculiar evaporating surfaces, may be employed to ameliorate the condition of some of our smaller swamps, especially in malarial districts. There is some reason for believing that experiments on certain drainage plants, especially species of Eucalyptus, may be productive of excellent results. The reports hitherto have been conflicting and inconclusive, and we have not yet sufficient data for forming a decision. In stations prepared for such investigations it would not be difficult to ascertain the value of plants for the purposes specified.[1]

[1] Consular Reports, 1894.

In the wide range of available forest trees from other countries there must be many which would, in virtue of this general law of increased vigor after transfer, be desirable objects for experiment as to general introduction or as factors in crossing. There could be no lack of species in any of these cases from which to select material for experimenting.

But it is in the vast group of species which have been under cultivation for long periods of time that we look for the most available objects for crossing and for improvement by selection. The triumphs in seed breeding in horticulture leave no room for doubt that greater successes are in store in the two other chief departments of cultivation, namely, forestry and agriculture.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of the oxids of iron and aluminum in presence of phosphoric acid, lime, and magnesia, F. S. SHIVER (*South Carolina Sta. Bul. 21, n. ser., p. 19*).—Pure solutions of lime, magnesia, iron, alumina, and phosphoric acid were prepared of such a strength that when 50 cc. of each were combined the mixture contained Fe_2O_3 and Al_2O_3 0.0509 gm., CaO 0.3010 gm., MgO 0.0307 gm., and P_2O_5 0.2570 gm., thus, it is claimed, approximating the proportions found in a solution of 1 gm. of natural phosphate. This solution was used in all cases except where it was desired to test the methods with one-half the above proportion of oxids of iron and aluminum.

Attention was directed principally to 3 methods, (1) the acetate method, (2) Jones' modification of the Glaser or alcohol and sulphuric acid method, and (3) a method involving features common to both of the above methods.

The hot acetate method with double precipitation was carried out as follows:

"The solution is diluted to about 400 cc. and neutralized with ammonia, then made acid with acetic acid, adding a few drops in excess, the solution then heated to near boiling for a few minutes, filtered hot, and the precipitate washed once or twice with hot water containing a little acetate of ammonia. The precipitate is now dissolved in hydrochloric acid and reprecipitated, . . . the precipitate washed, dried, ignited, and weighed as Fe_2O_3, Al_2O_3, P_2O_5. This precipitate is then dissolved in concentrated hydrochloric acid with the aid of heat, filtered if much silica is present, and the phosphoric acid determined in the filtrate by the molybdate process. The weight of phosphoric acid (P_2O_5) subtracted from the weight of the phosphates of iron and aluminum gives the weight of the oxids of iron and aluminum."

The same method of procedure, except that only 1 precipitation was made, and 2 modifications of Wyatt's[1] cold acetate method were also tested.

The Jones-Glaser method[2] used was as follows: Evaporate 50 cc. (corresponding to 1 gm. of material) to one-half its bulk and while hot add 10 cc. of one-fifth sulphuric acid; allow to cool and add 150 cc. of 95 per cent alcohol and let the whole stand over night; filter off the lime;

[1] Phosphates of America, p. 150.

[2] Ztschr. angew. Chem., 1891, p. 3; U. S. Dept. Agr., Div. Chem. Bul. 31, p. 85.

drive off the alcohol from the filtrate and rinse the residue in a beaker with water; oxidize the solution with nitric acid to destroy any aldehyde which may be present; add a slight excess of ammonia, which is immediately completely removed by heat; bring the precipitate of ferric and aluminic phosphates thus obtained upon a filter and carefully wash 4 times with boiling water, or if the washings are turbid, with a weak solution of ammonium nitrate; dry and weigh the precipitate of phosphate of iron and aluminum thus obtained; dissolve in concentrated hydrochloric acid by the aid of heat; filter if necessary, and determine the phosphoric acid present by means of the molybdic method.

The combined hot acetate and Jones-Glaser method used consisted—

"In throwing out the lime as directed by Jones, evaporating the alcoholic filtrate down to expel the alcohol, oxidizing with nitric acid, and then making an acetate precipitation (as already described under the hot acetate method) in this solution, filtering and washing the precipitate in the manner already described, igniting and determining phosphoric acid in the precipitate, difference being iron oxid and alumina."

This method was tested both on the pure solution and on solutions of Florida and South Carolina rock phosphates, and a study of the composition of the precipitates of phosphate of iron and alumina was made.

A summary of the results obtained by the different methods with pure solutions is given in the following table:

Determinations of oxids of iron and aluminum in presence of phosphoric acid

	Fe_2O_3 and Al_2O_3.	
	Theory.	Found.
Hot acetate method, double precipitation	0.0509 0.0255 0.0509	0.0506 0.0503 [1] 0.0498 [1] 0.0265 0.0501
Hot acetate method, single precipitation	0.0509	0.0509 [1] 0.0499
Wyatt's cold acetate method, original	0.0509	0.0464
Wyatt's cold acetate method, modified[2]	0.0509	0.0537 0.0521
Jones-Glaser method	0.0509	0.0553 0.0533
Jones hot acetate method	0.0509	0.0498 0.0504 0.0501 0.0503

[1] 0.02 gm. of fluorid of calcium added to the solution.
[2] Using only a slight excess of acetic acid.

The amounts of Fe_2O_3 and Al_2O_3 obtained in the solution of the natural phosphate were as follows: By Jones-Glaser method 3.18 and 3.20 per cent, Jones's hot acetate method 3.19 and 3.17 per cent.

The conclusions drawn from the above work are as follows:

"For a technical process the hot acetate method, single precipitation, will suffice; there is a possibility of being out of the way 0.2 to 0.3 per cent as a maximum limit.

"The hot acetate method, double precipitation, is accurate and can be relied on when properly conducted.

"The 'hot acetate—Jones modification proposed is accurate and in inexperienced hands is liable to give better results than the hot acetate method, double precipitation. In cases where lime is not to be determined, [it] is accurate and the manipulation simple and rapid.

"The Jones [Glaser] modification is accurate only in those cases where the quantity of magnesia is small in the material under examination, viz, a few tenths of a per cent; where the magnesia rises above this there is great danger in following this method."

Solubility of phosphoric acid of Thomas slag and other phosphates in citric acid solutions of various strengths, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1891, pp. 232–235*).—Determinations are reported of the solubility of phosphoric acid in Thomas slag with percentages of total phosphoric acid ranging from 18.7 to 23.6 per cent, of Mona guano with 29.2 per cent, of Canadian apatite with 39.68 per cent, and of Redonda phosphate with 37.82 per cent, using different amounts (100 to 200 cc.) and strengths (½ to 25 per cent) of acid and digesting for different lengths of time. The results indicate the necessity for the use of a large amount of the citric acid solution. By heating, less phosphoric acid was dissolved than under ordinary temperatures. With 2 per cent citric acid solution it was found that a considerable amount of phosphoric acid, which is not considered assimilable by plants, was dissolved from the apatite.

Experiments on the solubility of the phosphoric acid of Thomas slag in carbonic-acid water and dilute hydrochloric acid, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1891, pp. 235–239*).—One gram of Thomas slag was treated with carbonic-acid water for 24 hours, with occasional shaking. The solution was then decanted off through a filter and the residue washed with more carbonic-acid water in the beaker and finally on the filter. With Thomas slag containing 20.6 per cent of phosphoric acid, 71.84 per cent of the total phosphoric acid was dissolved by this treatment; with Thomas slag containing 15.1 per cent, 76.7 per cent was dissolved. By treating the same slag with 100 cc. of dilute hydrochloric acid (0.1 normal) for 24 hours all of the phosphoric acid was dissolved.

Note on the reduction of potassium platino-chlorid, E. SONSTADT (*Jour. Chem. Soc., 67 (1895), Sept., pp. 984, 985*).—The method proposed consists in rubbing up the platino-chlorid with mercury and gently heating the mixture, when "calomel sublimes together with the excess of mercury, leaving a very porous mass of platinum and potassium chlorid, which can be quickly washed. The reduction is completed, no trace of undecomposed platinum salt remaining, and if the mercury used is pure no foreign element is introduced."

Volatilization of salts during evaporation, G. H. BAILEY (*Jour. Soc. Chem. Ind., 14 (1895), No. 12, pp. 1020, 1021*).—The author finds that in evaporating solutions of the alkaline chlorids volatilization of the salt takes place, even when the evaporation is so conducted that it is impossible to suppose that the transfer has taken place through

spurting or other mechanical means. A series of experiments is reported showing that the volatility increases with the concentration and also with the molecular weight of the chlorid used.—A. M. PETER.

Duclaux's method for the estimation of volatile fatty acids, the laws governing volatility deduced therefrom, and their application to analysis: I. The mathematical deductions from the distillation of acids of the $C_nH_{2n+1}COOH$ series, H. D. RICHMOND (*Analyst, 20 (1895), No. 234, p. 193*).—The author states that other analysts have not obtained comparable results by the use of Duclaux's method; that he has obtained results agreeing approximately with those of the originator of the method; but, in addition to previously pointed out discrepancies, a recent study of the method has convinced him "that it is vitiated by unsuitable conditions of experiment," and that Duclaux's mathematical deductions from his results are erroneous.

The author presents a series of results on formic, acetic, propionic, butyric, valeric, and caproic acids, deduces an equation from Duclaux's and his own results, and concludes that "the following laws of the volatility of the acids $C_nH_{2n+1}COOH$ may be laid down:

"(1) Each acid of the series $C_nH_{2n+1}COOH$ on distillation in dilute solution behaves as a perfect gas and conforms to Henry's law.

"(2) Each acid has a fixed rate of distillation, which is an inverse function of its solubility in water, and is quite independent of the properties of the pure acid.

"(3) The apparent rate of distillation may be modified by condensation in the retort."—B. W. KILGORE.

The iodin number of fats and oils, H. SCHWEITZER and E. LUNGWITZ (*Jour. Soc. Chem. Ind., 14 (1895), No. 12, pp. 1030-1035*).—A study of the influence of solutions of iodin in different solvents on oils and fats and the influence of metallic salts in the solution of iodin. The total amount of iodin absorbed remaining practically the same, it was shown that with ethyl alcohol or ether as solvent addition of iodin predominated, while with methyl alcohol the action was mainly substitution, as measured by the formation of hydriodic acid. Carbon bisulphid and carbon titrachlorid effected addition exclusively. The authors' results upon different fats and oils under various working conditions are very interesting.—A. M. PETER.

The use of formalin as a preservative of milk samples, E. J. BEVAN (*Analyst, 20 (1895), No. 232, pp. 152-154*).—For some months the author has used formalin (a 40 per cent solution of formaldehyde) for preserving samples of adulterated milk for future reference. "Of its value as a preservative agent there can be no doubt. My own practice is to add 4 drops of the commercial article to the residue of the sample, which is usually about 4 oz. As a rule, my samples keep perfectly for 6 weeks, or even longer. Much depends, of course, on the condition of the milk when the sample is taken. If any considerable amount of decomposition has commenced, the formalin does not entirely prevent the decomposition continuing, but merely retards it."

A number of cases are mentioned in which the total solids in milk preserved with formalin increased slightly on keeping. He believes this to be largely due to the conversion of milk sugar into galactose.

Note on the detection of formalin, H. D. RICHMOND and L. K. BOSELY (*Analyst*, *20* (*1895*), *No. 232*, *pp. 154–156*).—A number of tests for formalin are mentioned, including one suggested by the authors, which is as follows:

"Bearing in mind Pulvermacher's researches, we have found a reaction between formalin and diphenylamin. A solution of diphenylamin in water is made, just sufficient sulphuric acid being added to will effect solution. The liquid to be tested (or the distillate) is added to this solution and boiled. In the presence of formaldehyde a white flocculent precipitate is deposited, which is often colored green if the acid used contained nitrates.

"We find it most convenient to distill into the diphenylamin solution and then boil. This simple test we believe to be characteristic of formaldehyde."

In the discussion following the paper the statement was made that "milk to which formalin had been added after curdling could not be brought to a thin liquid state by shaking up with ammonia," and this was confirmed by several. Attention was called to the recent investigations of Weigle and Merkel,[1] indicating that the addition of formalin to milk rendered the casein indigestible.

Estimation of neutralization agents in beer, E. SPAETH (*Forsch. Lebensmtl. Hyg. Chem.*, *2* (*1895*), *No. 11*, *pp. 303–312*).—The author states that none of the methods heretofore employed for the detection and estimation of neutralization agents in beer are at all reliable, and suggests the following, which he says is perfectly satisfactory. Five hundred cubic centimeters of beer from which the carbon dioxid has been removed by shaking is treated with 100 cc. of 10 per cent ammonia, left standing for 12 hours, and the mixture filtered.

Two portions of the filtrate, of 60 cc. each (equivalent to 50 cc. beer), are evaporated to dryness, incinerated, and the phosphoric acid determined.

Two hundred and fifty cubic centimeters of the filtrate is treated with 25 cc. of basic lead acetate, and allowed to stand for 5 or 6 hours after thorough mixing. The mixture is then filtered and 200 cc. of the filtrate is evaporated to 30 to 40 cc. to remove the ammonia, diluted with water, heated to boiling, and diluted to 200 cc. In 175 cc. of this liquid the lead is precipitated with hydrogen sulphid, and 150 cc. of the filtrate from the lead sulphid (equivalent to 113 cc. of beer) evaporated to dryness in a platinum dish, and the residue dried and incinerated. The perfectly white ash is dissolved in hot water, treated for 15 to 20 minutes with a current of carbon dioxid, heated to boiling, a measured quantity of decinormal sulphuric acid added (30 to 40 cc.), and the solution heated to boiling for about 30 minutes. It is then titrated with decinormal potassium hydroxid, using phenolphthalein as indicator.

[1] Abstracted in Analyst, 20 (1895), No. 232, p. 167.

The weight of the P_2O_5 multiplied by 1.4 gives the number of cubic centimeters of decinormal acid required to neutralize an ash of the beer from which the phosphoric acid has been separated. Each cubic centimeter of acid required in excess of this amount indicates that 0.00838 gm. of $NaHCO_3$ has been used to neutralize the beer.—W. D. BIGELOW.

Determination of fluorin in beer, J. BRAND (*Ztschr. ges. Brauw., 18 (1895), pp. 317–319; abs. in Chem. Centbl., 1895, II, No. 19, p. 906*).—One hundred cubic centimeters of beer is made slightly alkaline with ammonium carbonate, heated to boiling, and the fluorin precipitated with 2 or 3 cc. of a 10 per cent solution of calcium chlorid. After boiling about 5 minutes the precipitate is separated by filtration, washed with a very small amount of water, dried, and ignited in a small platinum crucible. One cubic centimeter of strong sulphuric acid is added, the crucible covered with a carefully ground watch glass, and heated for an hour on the water bath. This watch glass is kept cool with ice, the water formed being removed from time to time with cotton. The author can readily detect 1 mg. of ammonium fluorid, which is equivalent to 1 gm. per hectoliter. Quantitative determinations are made by comparison with a series of glasses etched with known amounts of fluorin.—W. D. BIGELOW.

Mineral, organic, and biological chemistry, A. GAUTIER (*Cours de chemie minerale, organique et biologique. Paris: G. Masson, 1895, vols. 1, pp. 622, figs. 241; 2, pp. 715, figs. 72; 3, pp. 827, figs. 122*).—This is the second edition of vols. 1 and 2, revised and enlarged.

A manual of qualitative chemical analysis, E. P. HARRIS (*New Ed.; Amherst, Mass.: 1895, pp. 315*).

The natural oxycelluloses, C. F. CROSS, E. J. BEVAN, and C. BEADLE (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, pp. 8–21*).

Maltose and trehalose, E. BOURQUELOT (*Rev. Sci., ser. 4, 4 (1895), No. 17, pp. 513–519*).

On the occurrence of two kinds of mannane in the root of Conophallus konyaku, Y. KINOSHITA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 4, pp. 205, 206*).

Liquefaction of gelatin; saline digestion of gelatin, A. DASTRE and N. FLORESCO (*Compt. Rend., 121 (1895), No. 18, pp. 615–617*).

Estimation of organic nitrogen by the Kjeldahl method, M. H. CAUSSE (*Rev. Agron., 4 (1895), No. 3, pp. 292–297*).

The determination of water and free acids in the sulphate of ammonia of commerce, J. HUGHES (*Rev. Agr. Île Maurice, 9 (1895), No. 11, pp. 269–271*).

A rotatory apparatus for the determination of citrate-soluble phosphoric acid in Thomas slag, K. MÜLLER (*Chem. Ztg., 19 (1895), No. 91, p. 2040, fig. 1*).

Temperature of the solidifying of the liquids of the organism in its application to the analysis of milk, J. WINTER (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 24, pp. 1101–1107; Jour Pharm. et Chim., ser. 6, 15 (1895), No. 12, pp. 558–560*).

Determination of furfurol from pentoses and pentosans, R. WELBEL and S. ZEISEL (*Monat. Chem., 1895, p. 283; abs. in Ztschr. angew. Chem., 1895, No. 22, p. 678*).

Lescoeur's "Séro-densimeter" for the control of milk, F. JEAN (*Ind. Lait., 20 (1895), No. 41, p. 322*).

Method of determining the fat of milk, L. LIEBERMANN and S. SZÉKELEY (*Ind. Lait., 20 (1895), No. 45, pp. 353, 354*).

Detection and estimation of preservative agents in milk, C. C. DUNCAN (*Agl. Students' Gaz., 7 (1895), No. 5, pp. 186-193*).

Notes upon the determination of nitrates in potable water, A. H. GILL and H. A. RICHARDSON (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, pp. 21-23*).

The coloring matter of natural waters, its source, composition, and quantitative measurement, ELLEN H. RICHARDS and J. W. ELLMS (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, pp. 68-81, charts 2*).

Note on the analysis of fruit juices, sirups, and confections, PY (*Jour. Pharm. et Chim., ser. 6, 15 (1895), No. 11, pp. 488-491*).

The use of physical methods for the examination of milk, wine, and beer, E. BECKMANN (*Forsch. Lebensmtl. Hyg. Chem., 2 (1895), No. 13, p. 367*).

The acidity of local wines, BEHREND (*Wurt. Wochenbl. Landw., 1895, No. 47, pp. 685-687*).

Influence of sulphurous acid on grape must, R. WISCHIN (*Ztschr. Nahr. Untersuch. und Hyg., 9 (1895), pp. 245-251; abs. in Chem. Centbl., 1895, II, No. 12, pp. 627, 628*).

Contribution to the analysis of must and wine, A. HALENKE and W. MÖSLINGER (*Ztschr. analyt. Chem., 34 (1895), pp. 263-269; abs. in Chem. Centbl., 1895, II, No. 9, pp. 511-513*).

A modification of Uffelman's reaction for the detection of lactic acid in the digestion fluids, H. STRAUSS (*Berl. klin. Wochenschr., 32 (1895), p. 805; abs. in Chem. Ztg., 19 (1895), No. 84, p. 308*).

An asbestus air bath, S. CERHEZ (*Ztschr. angew. Chem., 1895, No. 19, p. 561, figs. 2*).

Condenser for the determination of alcohol in beer, K. ULSCH (*Ztschr. ges. Brauw., 18 (1895), p. 244; abs. in Chem. Centbl., 1895, II, No. 11, p. 575*).

On a modified form of polarization apparatus for chemical purposes, H. LANDOLT (*Ber. deut. chem. Ges., 28 (1895), No. 19, pp. 3102-3104, figs. 2*).—The modification in the stand admits the introduction of other vessels than tubes and facilitates work at high or low temperatures.—A. M. PETER.

Honey analyses, A. J. COOK (*Michigan Sta. Rpt. 1893, pp. 371-383*).—A reprint of Bulletin 96 of the station (E. S. R., 5, p. 160).

Miscellaneous analyses, C. W. MCCURDY (*Idaho Sta. Bul. 9, pp. 29-31*).—Analyses are reported of 2 samples of cider vinegar, 4 of milk, and 2 of butter, and 1 test of kerosene oil.

Report of the chemical control station of Norway for 1894 (*State Agl. Rpt. Norway, 1894, pp. 83-138*).

BOTANY.

Is the amount of the transpiration of plants a measure of their adaptability to cultivation? E. KRÖBER (*Landw. Jahrb., 24 (1895), No. 3, pp. 503-537*).—The author criticises the work of Müller-Thurgau,[1] and concludes as follows:

(1) In determining the amount of transpiration it is necessary to determine it from an entire plant, and not from a portion and from that calculate the total. On account of the short time given the different experiments by Müller-Thurgau, the errors which originate by the water penetrating the wood tissue and not being transpired may under some conditions be very important.

(2) The transpiration of a branch can not be taken as a definite part of the transpiration of an entire tree.

[1] Mitt. Naturf. Ges. Thurgau, 1892, No. 10.

(3) The transpiration of different branches of the same tree may differ from each other more than the branches of different trees or even of different varieties.

(4) The relation of the amount of water transpired in parallel experiments is not constant.

(5) The varying factors which regulate transpiration manifest themselves differently toward different individuals.

(6) The present conditions and those under which the plant has previously transpired have a very great influence upon transpiration.

(7) It is not possible to consider, as Müller-Thurgau has done, that the measure of the transpiration of a twig will show the water requirement of an entire variety of plants.

Concerning the amount of water evaporated by the oat plant grown in solutions of different strengths, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 170–174*).—The amount of transpiration is known to be dependent on the condition of the atmosphere. Thus, oats grown in an atmosphere kept constantly humid transpired only 102 gm. of water for each gram of dry substance afforded, while in a dry atmosphere the amount of water transpired per gram of dry substance was 618 gm.

In water-culture experiments oat plants were grown in solutions containing 3, 1, 0.5, 0.25, and 0.1 per cent of plant nutrients. The solutions were formed according to the following formula:

$$4H\ KPO_4 + CaCl\ + 5Ca\ 2(NO\ ) + 2MgSO_4 + 2Fe.$$

The amounts of dry substance found were, with the 3 per cent solution 134 gm., with the 1 per cent solution 74 gm., with the 0.5 per cent solution 44 gm., with the 0.25 per cent solution 28 gm., and with the 0.1 per cent solution 18 gm. The amount of water transpired per gram of dry matter was, with the 3 per cent solution 515 gm., with the 1 per cent solution 550 gm., with the 0.5 per cent solution 684 gm., with the 0.25 per cent solution 688 gm., and with the 0.1 per cent solution 629 gm., the amount transpired being smaller the more concentrated the solution. The absolute quantity of water transpired increased from week to week until about the time of blooming, and afterwards decreased.

On the variation in weight and respiration in the plant organs of oats at various stages of their growth, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 157–161*).—The author experimented with 1,000 oat plants to ascertain their increase in weight and respiration. The results are tabulated in 13 8 day periods from the time of sowing the seed until harvest, when the plants were fully matured. It is shown that approximately the maximum weight for most of the organs was observed during the tenth period, which was the 8 days succeeding the end of flowering. The maximum production of carbon dioxid took place during the same period. The weight of grain of course increased after this time, the weight of grain and panicle attaining its maximum in the last period.

The maximum and minimum temperature for chlorophyll production in certain cultivated plants, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1891, pp. 151–157*).—The author investigated oats, rye, barley, wheat, buckwheat, peas, beets, and red clover, and he claims to have found the minimum temperature at which chlorophyll is produced, as follows: Rye, 7 to 8° C.; wheat, peas, and beets, 8°; red clover, 8 to 9°; oats, barley, and buckwheat, 9°. The maximum for the same plants was, for barley and peas, 30°; rye, oats, wheat, and beets, 35°; red clover, 35 to 40°; and buckwheat, 40°. From this it is seen that the range of temperature for chlorophyll production in the above-mentioned plants lies between 7 and 40° C. Experimenting with young plants, it was found that the death temperature lies from 5 to 10° above the maximum for chlorophyll formation, and that plants are able to live and grow in a temperature not suited to chlorophyll production.

Assimilation of free atmospheric nitrogen by microbes, S. WINOGRADSKY (*Arch. Sci. Biol., 1895, No. 3, pp. 297–352; abs. in Jour. Chem. Soc., 1895, July, pp. 283, 284*).—The author has succeeded in isolating from soil a butyric ferment which has the power of fixing free nitrogen. The name given the organism is *Clostridium pasteurianum*, and while differing from all known ferments it greatly resembles *C. butyricum* in its morphological characters. The nitrogen which is fixed is mainly in an insoluble organic form. The liquid products of the fermentation are chiefly butyric, with some acetic acid. The gas evolved consists of hydrogen 60 to 75 per cent, and carbonic anhydrid. Cultures were made in saccharine solutions without any combined nitrogen and in strictly anaërobic potato media, gelatine or broth proving too nitrogenous for use. The author states that 2 series of experiments conducted to test Berthelot's claim[1] that various soil organisms are capable of fixation of free nitrogen showed that of 15 separate species isolated only the Clostridium was able to assimilate nitrogen to any appreciable degree. In potato cultures 2 organisms were obtained which were capable of fixing small amounts of nitrogen in the presence of combined nitrogen.

The conclusion reached by the author is that the power of fixing nitrogen is not general among microörganisms, and the ability to exist without combined nitrogen seems to be confined to Clostridium alone.

Report on a collection of plants made by J. H. Sandberg and others in northern Idaho in the year 1892, J. M. HOLZINGER (*U. S. Dept. Agr., Division of Botany, Contributions to U. S. National Herbarium, vol. 3, No. 4, pp. 205–287, pls. 2*).—This report contains a list of species, together with critical notes and descriptions of new species, of plants collected during 1892 by J. H. Sandberg and others at various localities in northern Idaho and adjacent portions of Washington and Montana. The catalogue of specimens enumerates 1,272 numbers.

[1] Compt. Rend., 116 (1893), p. 842 (E. S. R., 4, p. 854).

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Contributions to a study of the genus Coleosporium, E. FISCHER (*Bul. Soc. Bot. France, ser. 3, 1 (1894), No. 2, Extraordinary session, Aug., 1894, pp. CLXVIII–CLXXIII*).—Notes are given of *C. inulæ*, *C. conchi-arrensis*, *C. senecionis*, *C. cacaliæ*, *C. petasitis*, *C. tussilaginis*, and *C. campanulæ*. The æcidial forms are given for these and other species.

A study of the genus Galactia in North America, A. M. VAIL (*Torrey Bul., 22 (1895), No. 12, pp. 500, 501*).—Descriptions and notes are given on 14 species and varieties of this genus, several of which are new.

Notes on the Hieraciums of Scandinavia, H. DAHLSTEDT (*Acta Horti Bergiani, 2 (1894), No. 4, pp. 146*).—A list of species, with critical notes, is given.

Concerning the species and varieties of Stipa, L. SIMONKAI (*Bot. Centbl., 64 (1895), No. 3, pp. 74–76*).

Notes on sumacs, W. W. ASHE (*Bot. Gaz., 20 (1895), No. 12, pp. 548, 549, pl. 1*).—*Rhus caroliniana* is described as a new species, and notes are given of *R. pumila*.

Concerning the difference between Gymnosporangium juniperinum and G. tremuloides, P. DIETEL (*Forst. naturw. Ztschr., 1895, No. 8; abs. in Bot. Centbl., 64 (1895), No. 5, p. 171*).

Some higher epiphytes, V. B. WITTROCK (*Acta Horti Bergiani, 2 (1891), No. 6, pp. 29*).—A list of about 75 genera of phanerogams and higher cryptogams that have been found living as epiphytes is given.

Contributions to the knowledge of monocotyledonous Saprophytes, P. GROOM (*Jour. Linn. Soc. Bot., 31 (1895), No. 214, pp. 149–215, pls. 3*).

On cultures of Penicillium cupricum, J. SEYNES (*Bul. Soc. Bot. France, ser. 3, 2 (1895), Nos. 6, pp. 451–455; 7, pp. 482–485*).—The author concludes that this is not a good species, but is only a form of *P. glaucum* modified as to the color of its conidia by the medium in which they are grown. Control experiments made with *P. glaucum* in solutions containing the sulphates of copper and iron gave, according to the author, results similar to cultures of the so-called *P. cupricum*.

On the location of the germ in the Angiosperm seed, F. HEGELMAIER (*Bot. Ztg., 53 (1895), I, No. 7, pp. 143–173*).

Variations in the sclerotia of Lentinus woermanni, N. PATOUILLARD (*Bul. Soc. Mycol. France, 11 (1895), No. 4, p. 246*).

On the vascular hyphæ of the mycelium of Autobasidiomycetes, C. VAN BAMBEKE (*Bul. Roy. Acad. Sci. Belge, ser. 3, 27 (1894), pp. 492–494*).—The present article is a résumé of an article published in the memoirs of the society.

Recent investigations concerning the secreting organs of fungi, J. ISTVANFFY (*Bot. Centbl., 64 (1895), No. 3, pp. 76, 77*).

On the form, structure, and division of the nucleus, O. VAN DER STRICHT (*Bul. Roy. Acad. Sci. Belge, ser. 3, 29 (1895), pp. 38–58, figs. 26*).

On the nuclei of the Uredineæ, G. POIRAULT and M. RACIBORSKI (*Jour. Bot. France, 9 (1895), No. 17, pp. 318–324, figs. 14*).

The rôle of the cell nucleus in the development of fungi, G. V. ISTVANFFI (*Ber. deut. bot. Ges., 13 (1895), No. 9, pp. 452–467, pls. 3*).

Experimental researches on the germination of Penicillium glaucum, P. LESAGE (*Ann. Sci. Nat. Bot., ser. 8, 1 (1895), No. 5–6, pp. 309–322*).—A study has been made of the external conditions necessary for the germination of the spores, as well as the conditions which hasten or retard germination.

Observations upon the development of Uncinula spiralis, B. T. GALLOWAY (*Bot. Gaz.*, *20* (*1895*), *No. 11*, *pp. 487–491*, *pls. 2*).

Investigations on the plasmolysis, elasticity, extensibility, and growth of pith, R. KOLKWITZ (*Inaug. Diss. Berlin, 1895, pp. 43; abs. in Bot. Centbl. Beiheft, 5* (*1895*), *No. 6, pp. 421, 422*).

On the relation between the assimilation activity of leaves and their drooping, L. JOST (*Jahrb. wiss. Bot.*, *27* (*1895*), *No. 3, pp. 77; abs. in Bot. Ztg.*, *53* (*1895*), *II, No. 21, pp. 321–333*).

On intracellular nutrition, E. DUCLAUX (*Ann. Inst. Pasteur*, *9* (*1895*), *No. 11, pp. 911–938*).

Digestion in plants, J. P. SMITH (*Sci. Amer. Sup.*, *40* (*1895*), *No. 1027, pp. 16410–16412*).

On the localization of respiration in the cell, J. LOEB and J. HARDESTY (*Arch. Physiol.*, *61*, *Nos. 11 and 12*).

Concerning the effect of internal and external conditions upon the transpiration of plants, O. EBERDT (*Prometheus*, *6* (*1895*), *No. 45*).

Experiments on the respiration of various cultivated plants, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 165–170*).—Tabulated results are given of experiments made by the author on the respiration of the various parts of buckwheat, mustard, and spurry.

Concerning the transpiration of the potato, L. POLJANEC (*Oesterr. bot. Ztschr.*, *45* (*1895*), *No. 10, pp. 369–374*).

A recording apparatus for the study of transpiration of plants, A. F. WOODS (*Bot. Gaz.*, *20* (*1895*), *No. 11, pp. 473–476, pl. 1*).—An illustrated description is given of a device for measuring the amount of transpiration in plants.

Water as a factor in the growth of plants, B. T. GALLOWAY and A. F. WOODS (*U. S. Dept. Agr. Yearbook 1894, pp. 165–176, figs. 4*).—The importance of water to the perfect development of the plant is pointed out, and the relation of the root system, through which the water is absorbed, to the total growth of the plant is stated.

On the movement of calcium phosphate in plants, L. VAUDIN (*Ann. Inst. Pasteur*, *19* (*1895*), *No. 8, p. 636; abs. in Chem. Ztg.*, *19* (*1895*), *No. 90, p. 339*).

Experiments on the assimilation of nitrogen by plants, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 261–270*).

The question of nitrogen assimilation by the bacteria of the root tubercles of lupines, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 270–272*).

Concerning some of the more important protective contrivances of the vegetative organs of plants, G. RAUME (*Osterprogram. Fr. Real. gym., Berlin; abs. in Bot. Centbl.*, *64* (*1895*), *No. 6–7, p. 229*).

On some variations in the number of stamens and carpels, I. H. BURKILL (*Jour. Linn. Soc. Bot.*, *31* (*1895*), *No. 214, pp. 216–245*).

Recent additions to the subject of polyembryony, K. SCHILBERSZKY (*Abs. in Bot. Centbl.*, *64* (*1895*), *No. 6–7, pp. 229–231*).

Vegetable spiralism, G. MACLOSKIE (*Torrey Bul.*, *22* (*1895*), *No. 11, pp. 466–470*).

Concerning the formation of ice in plants, with special reference to its anatomical arrangement, M. DALMER (*Flora*, *80* (*1895*), *No. 2, pp. 436–444; abs. in Bot. Centbl.*, *64* (*1895*), *No. 10, p. 353*).

Some problems of the physiology of transplanting, G. KLEBS (*Ueber einige Probleme der Physiologie der Fortpflanzung. Jena: G. Fischer*).

The dormant period in plants, C. T. DRURY (*Gard. Chron., ser. 3, 18* (*1895*), *No. 467, pp. 675, 676*).

On the poisonous action of oxalic acid salts, O. LOEW (*Bot. Centbl.*, *64* (*1895*), *No. 13, p. 434*).

Experiments on the injurious action on plants of waste water containing barium, E. HASELHOFF (*Landw. Jahrb.*, *24* (*1895*), *No. 6, pp. 962–967*).

Experiments on the injurious action on plants of water containing cobalt, E. HASELHOFF (*Landw. Jahrb.*, *24* (*1895*), *No. 6, pp. 959–961*).

Review of works on vegetable teratology and pathology published in 1892, 1893, and 1894, M. MOLLIARD (*Rev. gén. Bot., 7 (1895), Nos. 83, pp. 465–475; 84, pp. 525–543*).

On some chemical processes in the barley plant, C. F. CROSS, E. J. BEVAN, and C. SMITH (*Ber. deut. chem. Ges., 28 (1895), pp. 2604–2609; abs. in Chem. Centbl., 1895, II, No. 25, p. 1129*).

On the localization of anagyrine and cytisine, P. GUERIN (*Bul. Soc. Bot. France, ser. 3, 2 (1895), No. 6–7, pp. 428–433*).—A report is given on investigations of *Anagyris fœtida* and *Cytisus* spp. for these alkaloids.

On the presence of asparagin in the roots of Nelumbo nucifera, Y. KINOSHITA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 4, pp. 203, 204*).—The author has made an examination of the roots of this plant, which is largely used as food, and found that an approximate determination showed that the root contained asparagin amounting to nearly 2 per cent of its dry matter.

On the chlorophyll grains in seed and germinated plants, A. FAMITZIN (*Bul. Imp. Acad. Sci. St. Petersburg, n. ser., vol. 4, pp. 75–85; abs. in Bot. Centbl., 64 (1895), No. 12, pp. 417, 418*).

On the formation of gum in Acacias, L. LUTZ (*Bul. Soc. Bot. France, ser. 3, 2 (1895), No. 6–7, pp. 467–471*).

Concerning the existence of iron in plants, G. CUGINI (*Staz. Sper. Agr. Ital., 28 (1895), No. 11, pp. 619–652*).

On the distribution of assimilated iron compounds other than hemoglobin and hematins, in animal and vegetable cells, A. B. MACALLUM (*Quart. Jour. Micros. Sci., n. ser., 38 (1895), No. 150, pp. 175–274, pls. 3*).—A memoir.

Laccase in fungi, E. BOURQUELOT and G. BERTRAND (*Compt. Rend., 121 (1895), No. 22, pp. 783–786*).

The soluble ferments of Polyporus sulphurus, E. BOURQUELOT and H. HERISSEY (*Bul. Soc. Mycol. France, 11 (1895), No. 1, pp. 235–239*).

Concerning the tannins of fungi, O. NEUMANN (*Inaug. Diss. Dresden, 1895, pp. 46*).

Concerning the distribution of cane sugars in plants, their physiological rôle, and accompanying carbohydrates, E. SCHULZE and S. FRANKFURT (*Ztschr. Physiol. Chem., 20 (1895), No. 6, pp. 511–555*).

Composition of the root nodules of the alder, A. MAYER (*Landbouw. Tijdschr., 3 (1895), pp. 319, 320; abs. in Jour. Chem. Soc., 1895, Dec., p. 523*).—The following results were obtained: Crude protein, 9.8 and 5 7 per cent in nodules and roots, respectively; protein, 8.3 and 5.1; nitrogen-free extract, 61.6 and 60 5; crude fiber, 17.1 and 31.8; and ash, 8.2 and 2.0.

On the localization of the active principles of the Senecios, L. LUTZ (*Bul. Soc. Bot. France, ser. 3, 2 (1895), No. 6–7, pp. 486–488*).

Influence of the Mediterranean climate on the structure of the common plants of France, W. RUSSELL (*Ann. Sci. Nat. Bot., ser. 8, 1 (1895), No. 5–6, pp. 323–353, pls. 2*).

Variation after birth, L. H. BAILEY (*Amer. Nat., 30 (1896), No. 349, pp. 17–24*).

Some means of the dissemination of angiosperms, G. LA FORTE (*Nuovo Giorn. Bot. Ital., n. ser., 2, pp. 227–257; abs. in Bot. Centbl., 64 (1895), No. 4, pp. 129–131*).

New North American fungi, A. P. MORGAN (*Jour. Cincinnati Nat. Hist. Soc., 18 (1895), No. 1–2, pp. 36–45, pls. 3*).—Twenty-four new species are described, among which are the following new genera: Lentodium, Argynna, and Pyrenomyxa.

Remarks on Kellermann and Werner's Catalogue of Ohio Plants, J. F. JAMES (*Jour. Cincinnati Nat. Hist. Soc., 18 (1895), No. 1–2, pp. 46–57*).—Numerous notes are given as additions to the above catalogue.

On the flora of a prairie State, T. A. WILLIAMS (*Garden and Forest, 8 (1895), No. 407, pp. 493, 494*).—Notes are given of *Salix cordata* in South Dakota.

New or noteworthy American grasses, II, G. V. NASH (*Torrey Bul., 22 (1895), No. 11, pp. 463–465*).—Critical notes and new combinations of names are given for several species of Sporobolus, Eragrostis, and Poa.

New or noteworthy American grasses, III, G. V. NASH (*Torrey Bul.*, *22* (*1895*), *No. 12, pp. 511, 512*).—Critical notes are given of a few grasses.

Some points in photomicrography and photomicrographic cameras, W. H. WALMSLEY (*Amer. Micros. Jour.*, *16* (*1895*), *No. 12, pp. 369–378, figs. 5*).

New imbedding methods, G. MARPMANN (*Ztschr. angew. Mikros.*. *1* (*1895*), *No 8, pp. 234–238*).

A simple photographic camera for the microscope, C. LEISS (*Ztschr. angew. Mikros.*, *1* (*1895*), *No. 8, pp. 225–231, figs. 2*).

ZOÖLOGY.

The crow blackbirds and their food, F. E. L. BEAL (*U. S. Dept. Agr. Yearbook 1894, pp. 233–248, fig. 1*).—This paper deals with investigations of the food habits of the common eastern crow blackbird or purple grackle (*Quiscalus quiscula*), the bronzed grackle of the Middle States (*Q. q. æneus*), and the Florida grackle (*Q. q. aglæus*), prefaced by remarks on the geographical distribution of the forms considered. Observations on the diet of the crow blackbirds by field observers in different parts of the country are briefly cited.

In the course of the investigations there were examined the contents of the stomachs of 2,258 blackbirds from the eastern and central portion of the United States and from Florida. The food was found to show 18 per cent of animal, 18 per cent of vegetable, and 4 per cent of mineral matter. The animal food consisted chiefly of insects, which formed 46 per cent of the entire food of the year, although crustaceans, mollusks, and some small vertebrate animals were also eaten. The fewest insects were eaten in February, when they amounted to 6 per cent of the food, and the most in May, when they increased to 62 per cent. Beetles, grasshoppers, and caterpillars were chiefly eaten, although insects of other orders as well as spiders and myriapods were represented in the stomach contents. Only 37 stomachs out of the 2,258 were found to contain remains of eggs, although it is a popular belief that the blackbirds are nest robbers.

The vegetable food was found to consist chiefly of grain and fruit, although 37 different items in all were identified. Corn was eaten to the greatest extent, constituting one-half of the total vegetable food of the year. Wheat was also eaten to a small extent, both it and corn being found in greatest quantity in stomachs collected at the times of harvesting.

Fruit appeared to be an important dietary element and consisted chiefly of wild varieties. A considerable quantity of noxious weed seed was found in the stomachs collected during the winter and spring months.

One-fifth of the stomachs collected were those of nestling birds in which the insect food was found to largely predominate, consisting mostly of soft-bodied insects.

It is the belief of the writer that though the crow blackbirds may cause considerable injury at times when they collect in large flocks, the

damage is more than balanced by their destruction of injurious insects, and that they should not be indiscriminately destroyed.

Hawks and owls from the standpoint of the farmer, A. K. FISHER (*U. S. Dept. Agr. Yearbook 1891, pp. 215-232, pls. 3, figs. 4*).—A popular illustrated paper protesting against the indiscriminate prejudice commonly existing in regard to birds of prey, and showing that the majority of them are not only harmless but positively beneficial to farmers by destroying injurious mammals and insects. Birds of prey are arbitrarily divided into those wholly beneficial, those chiefly beneficial, those in which the beneficial and harmful qualities about balance, and those harmful. The gyrfalcons, duck hawk, sharp-shinned hawk, Cooper's hawk, and goshawk are comprised in the harmful class, while the vast majority of all other hawks and owls are either wholly or chiefly beneficial. The conclusions are arrived at from study of the habits of the different species and examination of the stomach contents of about 3,000 individuals, the results being briefly detailed for several species. Illustrations are given of the red tailed hawk, sparrow hawk, barred owl, Swainson's hawk, burrowing owl, great horned owl, and Cooper's hawk.

The food of woodpeckers, F. E. L. BEAL (*U. S. Dept. Agr., Division of Ornithology and Mammalogy Bul. 7, pp. 1-33, figs. 5*).—This is a preliminary report on investigations concerning the food of woodpeckers in relation to their economic value as friends or foes of the agriculturist and horticulturist. Six hundred and seventy nine stomachs were examined, representing 7 species—the downy woodpecker, hairy woodpecker, flicker, red-headed woodpecker, red-bellied wood pecker, yellow-bellied woodpecker, and pileated woodpecker. The ani mal food, consisting almost entirely of insects, was found to be greatest in the downy woodpecker, the stomach of which contained 74 per cent animal, 25 per cent vegetable, and 1 per cent mineral matter, and ranged down through the hairy woodpecker, flicker, pileated woodpecker, red-headed woodpecker, and yellow-bellied woodpecker to the red-bellied, in which there was 26 per cent animal and 74 per cent vegetable matter, with a trace of mineral matter. The most mineral matter was found in the stomachs of flickers, and none in those of the yellow-bellied and pileated woodpeckers. The majority of the stomachs contained cambium from the bark of various trees.

The downy woodpecker is considered to be of the most economic value from the greater proportion of insects in its food, few of which were of useful species. All the woodpeckers were found to eat grasshoppers, the red-head eating the largest percentage, these and beetles forming 36 per cent of the whole food. The food of each species is listed in more or less detail, and the positive advantage to farmers and to granaries from the insectivorous tastes of woodpeckers is insisted upon.

The tongues of woodpeckers, F. A. LUCAS (*U. S. Dept. Agr.*,

Division of Ornithology and Mammalogy Bul. 7, pp. 35–44, pls. 3).—A brief semitechnical article dealing with the anatomy of woodpeckers' tongues and showing that the variation in form is due to the character of the food of the species and the methods pursued by the birds in obtaining it, some species having tongues adapted to the spearing of larvæ within their burrows, and thus extracting them, while the tongues of others are furnished with rough surfaces to which the saliva will adhere. It is believed that since the modifications of the tongue are directly related to the character of the food they are not of value for classification. Enlarged figures of the tongues of various North American woodpeckers are given.

The geographic distribution of animals and plants in North America, C. H. MERRIAM (*U. S. Dept. Agr. Yearbook 1894, pp. 203–214, map 1*).—A popular article showing the results achieved by the Division of Ornithology and Mammalogy in studying the life zones and areas in North America, in mapping their boundaries, and tabulating their distinctive animals and plants. The scope of work in the line of geographic distribution as carried out by biological surveys, and correlation of the data collected by this and other means, is briefly outlined and the recent Death Valley expedition to Southern California is mentioned. The author characterizes 7 life zones, included under 3 main divisions, the Boreal region, comprising the Arctic, Hudsonian, and Canadian zones; the Austral region, comprising the Transition, Upper Austral or Carolinian, and lower Austral or Austroriparian zones; and the Tropical region, constituting a Tropical zone. These zones are briefly described, their boundaries in the United States indicated, and the more characteristic species named. A map of the zones is given. The laws of temperature control, and their bearing on the zones are briefly formulated.

The poisonous snakes of North America, L. STEJNEGER (*U. S. Nat. Mus. Rpt. 1893, pp. 337–487, pls. 19, figs. 70*).—A semipopular paper, with illustrated technical descriptions of and keys to 4 genera and 16 species, to which are attached remarks upon the venom of snakes, its composition, physiological action, and treatment.

The short-eared owl (*Jour. [British] Bd. Agr., 1 (1895), No. 3, pp. 278–280, fig. 1*).—Description, habits, and value of *Asio accipitrinus*.

Birds of Michigan, A. J. COOK (*Mich. Sta. Rpt. 1893, pp. 192–356, figs. 112*).—A reprint of Bulletin 94 of the station (E. S. R., 5, p. 161).

On the protection of useful birds, J. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No 28, pp. 32, 33*).—A list of useful birds is given and their protection by horticulturists is urged.

The wild birds' protection act of 1894, C. WARBURTON (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 365–369*).—A list of birds beneficial to agriculture is given.

The destruction of birds useful to agriculture, X. RASPAIL (*Rev. Sci., 1895, May 25, p. 669*).

The birds' calendar, H. E. PARKHURST (*London: J. C. Nimmo, 1895, pp. 350, figs. 24*).—A popular treatise on some American birds.

METEOROLOGY.

Climate and Health, W. L. MOORE and W. F. R. PHILLIPS (*U. S. Dept. Agr., Weather Bureau, Climate and Health, 1 (1895), No. 1, pp. 1–25, charts 20*).—This is the first of a series of publications on this subject and covers the 4 calendar weeks ending Saturday, July 27, 1895.

The statistics used "are based upon climatologic reports of the regular stations of the Weather Bureau, and upon morbidity and mortality reports of physicians and health officials made directly to the Weather Bureau, and supplemented as to mortality statistics by additional information taken from the Mortality Table, Cities of the United States, of the Abstract of Sanitary Reports, published by the U. S. Marine-Hospital Service."

"The climatologic data used in determining the weather characteristics of each week are taken from about 130 of the regular stations of the Bureau. Climatologic statistics of 99 selected stations are published in detail. Morbidity reports were received from about 106 physicians, the number varying somewhat from week to week. Mortality statistics were received from about 150 localities. . . . The statistics have been compiled by the calendar week. The matter of each week, except the charts, will be found in the following order: Text, climatologic tables, morbidity, and mortality tables. The weeks follow each other in chronologic order."

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 22 (1894), No. 13, pp. VII, 13, charts 3*).—This number contains the title-page and table of contents of the Review for 1894 and an annual summary of meteorological observations during 1894 "based upon data received from coöperating weather services and from about 1,600 stations occupied by regular and voluntary observers of the Weather Bureau." In addition, a summary of Canadian observations is given and the data from this source are incorporated in the charts.

"*Atmospheric pressure.*—The mean annual pressure has been highest during 1894 over the South Atlantic and East Gulf States, the maximum being 30.13 in Georgia; the small area of lowest pressure, 29.90, appears, as usual, at the head of the Gulf of California, and, as has been previously explained, is probably a branch from the area of low pressure over the equatorial Pacific. A small region of high pressure extends eastward over Oregon into Utah. The general Arctic area of low pressure, 29.95 or less, extends along our northern boundary from British Columbia to Newfoundland. . . .

"*Temperature.*—The lowest annual averages within the United States were: Williston, 40.1; St. Vincent, 37.7; Moorhead, 30.8; Duluth, 41.5; Burlington, 42.6; Eastport, 41.6. The highest averages were: Yuma, 71.4; Corpus Christi, 70.7; Key West, 76.7; Jupiter, 73.8.

"The mean annual temperature was above the normal in New England, the Middle and South Atlantic States, and generally throughout the interior of the country; it was slightly below the normal in Florida and the Gulf States, the plateau, and Pacific coast regions. . . .

"In general, maximum temperatures exceeding 100 occurred from the Mississippi Valley westward to the Rocky Mountain slope up to an altitude of 3,000 or 4,000 ft.; the absolute maximum for the whole country was 113 at Yuma.

"Minimum temperatures of 35° or less occurred in the eastern portion of North and South Dakota; the minimum line of freezing temperature, 32°, extended northward to the immediate coast of California and the southern point of Florida. The stations of large annual range of temperature were: Northfield, 124; Sault Ste. Marie, 120; North Dakota, on the average, 136; St. Paul. 125; Des Moines, 131; Valentine, 141; Huron, 143; Pierre, 136; Miles City, 133; North Platte, 129; Idaho Falls, 124.

"The small annual ranges were: Hatteras, 69; Jupiter, 67; Key West, 47; Santiago, 58; Los Angeles, 67; San Francisco, 58; Eureka, 51; Tatoosh Island, 51.

"The accumulated departures of average monthly temperatures are given, and show that there was a progressive accumulation of temperature in excess of the normal in most of the meteorological districts. In other cases, such as Key West and the Gulf States, the plateau and Pacific districts, the accumulation of the early part of the year diminished or even became a deficit before its close. . . .

"*Precipitation.*—The greatest precipitation was 114 in. at Tatoosh Island, and the least was 2.95 at Yuma, 4.24 at El Paso, and 4.35 at Santiago.

"An annual rainfall above 60 in. occurred on the immediate coast of Oregon and Washington and over a small portion of the Florida Peninsula. An annual rainfall of less than 20 in. prevailed from Manitoba west to Alberta and southward to Mexico.

"[From] the accumulated departures of total monthly precipitations from the normal values it appears that a deficit has prevailed, except over the northern plateau and Pacific coast districts, and, in general, the deficit has been increasing from month to month throughout the year."

This number also contains notes on the frequency of thunderstorms and auroras, tables for reducing barometer readings to sea level by the Hazen method, which is used in the Weather Bureau, and an article on "The total quantity of aqueous vapor in the atmosphere," by C. Abbe.

Meteorological summary for Iowa for 1894, J. R. SAGE and G. M. CHAPPEL (*Iowa Weather and Crop Service Rpt. 1894, pp. 52, chart 1*).—The tables and summaries of meteorological data and crop statistics embodied in this report were made up from the weekly and monthly reports of 1,100 voluntary observers and crop correspondents, representing every county in the State. The summary for the year is given in brief as follows:

"*Barometer.*—Mean pressure for the year, 30.036 in.; highest observed, 30.96 in., on December 27, at Sioux City; lowest observed, 29.20 in., on February 9, at Keokuk; range for the State, 1.76 in.; average monthly range, 1.10 in. *Temperature.*—Mean temperature for the year, 49.7°; highest temperature reported, 109°, on July 26 and 27, at Spirit Lake; lowest, —37°, on January 25, at Ames; range for the State, 146°; average monthly range, 78.8°. *Precipitation.*—Average for the State, 21.95 in.; the greatest monthly rainfall reported was 7.43 in., at Keosauqua, in September; the least was trace at numerous places in February, July, August, and November; the greatest amount reported for any 24 consecutive hours was 2.77 in., at Atlantic, on the 1st of October. *Wind.*—Prevailing direction, northwest; maximum velocity reported was 70 miles an hour, from the south, at Sioux City on June 20.

"There were 184 clear days during year. 109 partly cloudy, 72 cloudy, and 66 days on which 0.01 in. or more of precipitation fell."

Meteorological observations at Michigan Station during 1892, R. C. KEDZIE (*Michigan Sta. Rpt. 1893, pp. 61–85*).—As in previous years these observations include data relating to temperature, pressure, relative humidity, pressure of vapor, cloudiness, wind movement, and precip-

itation. The annual summary is as follows: *Temperature* (degrees F.), highest 93 (June 25, 26), lowest —13 (January 15), mean 45.88; *pressure* (inches), mean 29.096; *mean relative humidity* (per cent) 78; *pressure of aqueous vapor* (inches) 0.291; *cloudiness* (per cent) 57.5; *total precipitation* (inches) 29.92; *snowfall* (inches) 30.5.

What meteorology is doing for the farmer, M. W. HARRINGTON (*U. S. Dept. Agr. Yearbook 1894, pp. 117–120*).—A brief explanation of improvements with special reference to the needs of the farmer on the following points:

"The improvement of the forecasts—their more complete distribution, especially to the farming communities; the general dissemination of information about the Weather Bureau—its objects and methods, what could or could not be properly expected of it; the compilation and publication of the climatic data of the United States, especially the data of use in the practical pursuit or study of agriculture—permitted by the accumulation of 20 or 25 years of observations of uniform character; the study of the scientific theory of meteorology with especial reference to the improvement of its practical application."

Present and proposed lines of work, including flood forecasts, sanitary climatology, the study of clouds, and seasonal forecasts are briefly referred to.

The value of forecasts, H. H. C. DUNWOODY (*U. S. Dept. Agr. Yearbook 1894, pp. 121–128*).—A popular article intended "to set forth as briefly as possible the diversified interests affected directly by the forecasts, and to give some approximate values of the benefits accruing from judicious use of the same."

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 23 (1895), Nos. 1, pp. 1–45, charts 32; 2, pp. 46–80, charts 7; 3, pp. 81–116, charts 9; 4, pp. 117–155, charts 6; 5, pp. 156–197, figs. 2, charts 8; 6, pp. 198–239, charts 5; and 7, pp. 240–282, charts 6*).—In addition to the usual summaries of observations, No. 1 contains notes on observations on snow dust in different parts of the country, including microscopical examinations by B. T. Galloway and A. F. Woods, and physical analyses by M. Whitney, which indicate that this dust has no greater fertilizing value than ordinary surface soil; No. 3 contains an article by F. H. Bigelow on the connection between sun spots and the weather; No. 5 contains a special article on cloud photography by A. J. Henry, and on meteorology and public health by W. F. R. Phillips; No. 6 contains statistics of State Weather Services by O. L. Fassig; and No. 7 contains an illustrated article by C. F. Marvin on the Marvin seismograph. Editorial notes occur in the different numbers as follows: No. 1, the local contrast of weather at Long Branch; the ice crop from a meteorological standpoint; a silent electrical and duststorm in Oklahoma; optical phenomena; and parhelion, January 27, 1895; No. 2, correspondences between European and American weather; optical phenomena at Washington, D. C.; descending warm winds; duststorm; and noise made by a meteor; No. 3, sensible temperatures, and the warm wave of March 27–29; No. 4, the passage of low areas over the Rocky Mountains; duststorms; change from winter to summer; thunder and air pressure; the wind and chimney draft; efficiency of windmills and farmers' tools; do thunderstorms advance against the wind? and a list of popular works on meteorology; No. 5, frosts in May at Mardela Springs, Maryland; rainfall and barometric pressure; dry norther in Nevada; green-colored sun of September 9, 10, 1883; and tornadoes of May 3, 1895; No. 6, horizontal cloud roll; the weather and the birds; the dry northers of California; forecasting monsoon rains; and an item in the early history of weather telegraphy; and No. 7, cloud photography; observations in Alaska; and miscellaneous phenomena.

Meteorology as a university course, R. DEC. WARD (*Amer. Met. Jour., 12 (1895), No. 8, pp. 242–250*).

Weather forecasts for the benefit of agriculture, C. HUGUES (*Ist. Agr. Staz. Sper. Istria Parenzo, 1895, pp. 11*).

On predictions of night frosts, and some remedies for the same, J. SEBELIEN (*Norsk Landmansblad, 14 (1895), pp. 445–448*).

Thermometers for prediction of night frosts (*Norsk Havetidende, 11 (1895), pp. 91–93*).

Rainfall and temperature, N. F. UNDERWOOD (*Agriculture of Pennsylvania, 1894, pp. 284–289*).—A brief general discussion of the influence of these factors upon agricultural production.

On the double diurnal oscillation and relative humidity, A. ANGOT (*Compt. Rend., 121 (1895), No. 17, pp. 595, 596*).

The effects of the tropic revolution of the sun and moon on barometric pressure, P. GARRIGON-LAGRANGE (*Compt. Rend., 121 (1895), No. 23, pp. 844–847*).

The resistance of vertical earth-air currents in the United Kingdom, RÜCKER (*Chem. News, 72 (1895), No. 1882, p. 301*).

Psychrometer studies, N. EKHOLM (*Amer. Met. Jour., 12 (1895), No. 8, pp. 237–242*).—A reply to an article by Professor Hazen on this subject in the February number of the journal.

Effect of the wind on soils in Iceland, J. H. JOHNSTON-LAVIS (*Scot. Geog. Mag., 1895, Sept.; abs. in Amer. Met. Jour., 12 (1895), No. 8, p. 261*).

Observation of an electric phenomenon, METHTAL (*Compt. Rend., 121 (1895), No. 18, pp. 596, 597*).

A mechanical device for performing the temperature corrections of barometers, J. SHIELD (*Chem. News, 72 (1895), No. 1882, p. 301*).

Meteorological observations, J. B. SAGE and G. M. CHAPPEL (*Iowa Weather and Crop Service Monthly Review, 1895, Oct., pp. 11*).

Meteorological observations at Massachusetts Hatch Station, September and October, 1895, L. METCALF and C. A. KING (*Massachusetts Hatch Sta. Met. Buls. 81 and 82, pp. 4 each*).—These include notes on the weather during these months and the usual summaries of observations at the meteorological observatory of the station.

North Carolina weather, September and October, 1895, H. B. BATTLE, C. F. VON HERRMANN, and R. NUNN (*North Carolina Weather Service Buls. 72, pp. 15, maps 2; and 73, pp. 15, maps 2*).—The usual summaries.

AIR—WATER—SOILS.

Water analyses, E. E. SLOSSON (*Wyoming Sta. Bul. 24, pp. 99–111*).—A general discussion on water and water supply and notes on methods of analysis and on the interpretation of the results of chemical examinations of water, with chemical analyses of a number of samples of irrigation water used at the different substations in Wyoming and of well and spring water from different localities in the State, including samples of artesian water and mineral waters of various kinds.

Special attention was given to a study of the relation of the irrigation water to the soluble salts (alkali) in the soil. Examinations were made at Laramie of the water applied to plats planted to various crops and that which ran off from the surface. These showed that the waste water contained more salts than the water applied; that in the waste water the carbonates of the irrigation water were largely replaced by sulphates, and that the waste water contained more potash in proportion to soda and more magnesia in proportion to lime than the water applied.

The size of soil particles, H. SNYDER (*Minnesota Sta. Bul. 41, pp. 58–63, figs. 2*).—The rôle of the different-sized particles of the soil is explained and the mechanical constitution and characteristics of 4 typical Minnesota soils, viz, (1) wheat soils, (2) corn soils, (3) medium grass and grain soils, and (4) potato soils, are explained with illustrations.

The method used in the mechanical analysis of the soils was a modification of the Osborn beaker method.

"The coarse sand was first removed, and then the medium sand, by means of sieves of the form of Gooch crucibles specially made for this work. The clay was then separated from the silts and fine sand by means of centrifugal action, using the microscope to indicate when the separation was complete. By this means the usual 24 hours' precipitation was avoided. The fine sand and the 2 grades of silt were then separated in the usual way."

Soils in their relation to crop production, M. WHITNEY (*U. S. Dept. Agr. Yearbook 1894, pp. 129–161, figs. 11*).—This article deals with (1) the truck soils of the Atlantic seaboard, (2) the tobacco soils of Connecticut and Pennsylvania, and (3) conditions in soils of the arid region. Under the first head are discussed essential factors of successful truck farming, constituents of typical truck soils, and physical characteristics and adaptations of truck soils of Florida, South Carolina, eastern North Carolina, Virginia, and Maryland; under the second the adaptation of soils to varieties of tobacco, with special reference to the tobacco soils of the Connecticut Valley and Pennsylvania; and under the third a comparison of arid and humid regions, the depth of soil moisture, hot winds, advantages of understanding soil conditions, and subsoiling.

Comparison of different methods of farming upon the conservation of the fertility of the soil, H. SNYDER (*Minnesota Sta. Bul. 41, pp. 68–79, chart 1*).—In connection with a study of the soils of Minnesota data were collected relating to the methods of farming pursued which are used as the basis of a discussion of the increase and outgo of the fertilizing constituents of the soil in (1) all grain farming, (2) mixed grain and general farming, (3) mixed potato and general farming, (4) stock farming, and (5) dairy farming. The average amounts of nitrogen, phosphoric acid, and potash removed annually from 160 acres of land under different systems of farming are given as follows:

Loss of fertilizing constituents under different systems of farming.

	Nitrogen.	Phosphoric acid.	Potash.
	Pounds	*Pounds.*	*Pounds.*
All grain farming	5,600	2,500	4,200—
Mixed grain and general farming	2,600+	1,000	1,000+
Mixed potato and general farming	2,300+	1,000—	2,400+
Stock farming	900	[1]50	60
Dairy farming	800	[1]75	85

[1] Gain.

"The figures given in the table are not intended to convey the idea that an equivalent amount of each element must always be returned to the soil, but they are intended to show where the heaviest drafts fall upon the soil with each system of farming.

"In making comparisons, the variations which are liable to occur should be kept in mind. In exclusive grain farming the loss of the nitrogen is greater than given, because when the soil is continually uncovered by the cultivation of plowed crops some of the nitrogen is lost by drainage and by the decomposition of the humus. When clover is grown in the other systems of farming, the loss of the nitrogen is less than stated. In the illustration this is represented by a part of the nitrogen being set off with cross lines.

"The annual loss of phosphoric acid with exclusive grain farming is nearly 2,500 lbs. per 160 acres. With mixed grain or potato farming this loss is reduced to about 1,000 lbs.

"With stock farming, when all of the crops are fed to the stock on the farm and a small amount of milled products is purchased, there is practically no loss of phosphoric acid and potash except in the handling of the manure. When the manure is well cared for, the losses of these elements are both less than stated in the tables.

"In the case of dairy farming, or stock farming, when all of the skim milk is fed on the farm, and a part of the grain is exchanged for more concentrated milled products, there is no loss, but on the other hand a constant gain of fertility to the soil."

The essential elements of soil fertility, H. SNYDER (*Minnesota Sta. Bul. 11, pp. 3-11, figs. 5*).—To illustrate the necessity of certain elements to plant growth "oats were grown in various ways by preparing the soil so that each of the elements, nitrogen, phosphorus, potassium, and calcium, were in turn withheld, while all the other elements were present. The results of withholding these elements of food are given, as well as an illustration of the plant. The approximate period of growth when each element is assimilated is given, and the portion of the plant where the element is most abundantly found; and also the part which this element takes in the nutrition of the plant."

The author adds calcium to the list of essential elements of plant food most liable to be deficient in soils.

Humus as a factor of soil fertility, H. SNYDER (*Minnesota Sta. Bul. 11, pp. 12-31, pl. 1*).

Synopsis.—Conclusions from previous investigations reported in Bulletin 30 of the station (E. S. R., 5, p. 857) regarding humus as a factor of soil fertility were verified by further experiments. Oats were successfully grown and produced seed in sand in which the plant food was supplied only in the form of humates of lime, potash, iron, etc., extracted from soils by alkaline solutions, provided the humates had been previously inoculated with soil extract and allowed to ferment. Experiments on manured and unmanured soils are reported in which additions of manure caused an increase of 25 to 30 per cent in the amount of potash, lime, and phosphates combined with humus.

Previous investigations by the author on Minnesota soils had indicated that a loss of humus in the soil resulted in a decline of fertility, due to a loss both of nitrogen and of available phosphates. These investigations showed that 15 years of continuous cropping "has resulted in a loss of 0.15 to 0.20 per cent of nitrogen, which is equivalent to 3,000 to 5,000 lbs. of nitrogen per acre. Only a small part of this nitrogen

has been removed in crops," in fact, 50 lbs. per year is stated to be a large amount for any ordinary grain crop to remove.

To study the influence of the somewhat common practice of summer fallowing on this loss of humus and nitrogen, the following experiment was carried out in the spring of 1892:

"A large box was filled with soil from a field that was to undergo summer fallowing. The soil was thoroughly mixed and a sample taken for analysis. The box was then placed in the soil, so no leaching could take place, and was protected from the access of any foreign material. At frequent intervals the box was stirred, imitating as closely as possible the cultivation of the summer fallow plat. The box was kept free from vegetation. In the following spring, after one year of fallow, the soil in the box was again sampled and submitted to analysis. The available nitrogen includes the nitrates, nitrites, ammonium, and amid compounds.

"The results of the analyses, before and after the summer fallow treatment, are given:

Nitrogen in soil before and after fallowing.

	Before fallowing.	After fallowing.
	Per cent.	*Per cent.*
Total soil nitrogen	0.1536	0.1422
Available soil nitrogen	.0021	.0043

"There was a loss of 0.0114 per cent total nitrogen and a gain of 0.0022 per cent of available nitrogen. For every pound of nitrogen rendered available by the fallow treatment there was a loss of over 5 lbs. of nitrogen from the soil. Bare summer fallow is only temporarily beneficial at the expense of the total humus and nitrogen in the soil. In the end summer fallowing will be found to be injurious to the soil."

The importance of humus as a conserver of the moisture and the decline of the retentive power of soil for water consequent upon the loss of humus is illustrated by the following observations, taken from a number of others, made on samples of soils taken from similar fields containing different amounts of humus:

Water content of soils containing different amounts of humus.

	New soil cultivated 2 years.	Old soil cultivated 22 years
	Per cent.	*Per cent.*
Humus	3.75	2 50
Water	16 48	12.14

"In this example the difference of 1.34 per cent of water in favor of the soil with the larger amount of humus is equivalent to 1¼ qts. of water per cubic foot of soil. . . .

"These 2 samples of soil were placed in shallow trays and exposed to the sun (temperature 85° F., humidity 58) for 10 hours. The soil with the 3¾ per cent humus retained 6.12 per cent water, while the soil with the 2½ per cent humus retained 3.94 per cent water, a difference of nearly a quart of water in a cubic foot of soil."

The relation between the humus content and the weight per cubic foot, capacity to hold water, etc., is well shown by the following data

relating to 3 typical soils selected from a large number of similar character:

Relation of humus content to physical and chemical qualities of soil.

	No. 1.		No 2.		No. 3.	
	Cultivated 2 years.	Cultivated 10 years	Native soil	Cultivated 23 years.	Cultivated 42 years.	Cultivated 35 years.
Weight per cubic foot, pounds . per cent	57 00	66 00	67.00	72.00	67.00	70.00
Total humus.................. do	5.30	3.38	3.97	2.59	3.46	2.45
Total nitrogen . ... do ..	0 42	0 33	0 36	0.19	0.26	0 21
Capacity to hold water......... do	72.00	65 00	62 00	54.00	59 00	57.00
Phosphates associated with humus per cent	0.05	0 03	0.07	0.03	0.03	0 03

The particular objects of the present investigations, however, were to determine whether decaying organic matter, like barnyard manure, when added to the soil, combines with the soil potash, phosphates, etc., to form humates; and to what extent plants are capable of utilizing the mineral constituents of these humates.

One hundred pounds of soil was placed in a box and 20 lbs. of cow manure added to it.

"The total amount of humates (reprecipitated) present in the original soil was determined by chemical analysis; also the amount of potash, lime, phosphates, etc., in the manure that was added. The box was protected from dust and other foreign matters and kept moist, and was occasionally well mixed. At the end of 12 months a sample was taken and again submitted to chemical analysis. . . .

"At the same time another box was taken and filled with the same kind of soil, but no manure was added. This box received the same kind of treatment, in every way, as the box with the manure."

The results obtained in both cases are given in the following table, in which the figures represent the "ash of the reprecipitated humus materials."

Humates in manured and unmanured soil.

	Potash.	Soda	Iron	Magnesia.	Alumina	Phosphoric acid
Manured soil	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*
Humates in 100 lbs. of original soil	7 25	7 84	2 44	0 35	2 96	11 97
Humates at end of 12 months	9 14	10 11	4 13	0 54	4 64	13.99
Gain......	1 89	2.27	1.69	0 19	1.68	2 02
Unmanured soil						
Humates in 100 lbs of original soil	7 25	7.84	2 44	0 35	2 96	11.97
Humates at end of 12 months	6.92	7.50	2 46	0 27	2 75	11.50
Loss....	0.33	0.34	....	0.08	0.21	0.47

"The cow manure, acting upon the loam soil and combining with it, has caused an increase of 25 to 30 per cent of potash, lime, and phosphates, in the form of humates, over the original amounts in the soil. The cow manure has not simply added new elements of fertility to the soil, but has changed a part of the potash, lime, and phosphates already in the soil into more available forms."

Experiments to determine the power of oat plants to feed on humates were made in boxes of sterile sand, to which a small amount of gypsum had been added, as follows: (1) Unfermented humates were added, but the plants made but little growth, their appearance indicating nitrogen starvation; (2) humates which had been inoculated with soil leachings and allowed to ferment at about 90° F. in a dark place for 5 weeks were added, and the plants grew slowly at first and finally produced some seed; (3) unfermented humates to which a small amount of potassium sulphate had been added were used, but the plants died after 5 weeks' sickly growth; (4) calcium phosphate was added to the unfermented humates, but the plants died after 4 weeks' sickly growth; (5 and 7) check experiments in sterile sand produced a few sickly plants; and (6) calcium nitrate was added to the unfermented humates, and the plants "made a good growth during the first 3 weeks and a restricted growth after that time for 4 weeks longer," but produced no seed.

"These experiments taken as a whole plainly indicate that the potash, phosphorus, and lime, as well as the other essential elements of plant growth as they exist in the soil, combined with the humus in the form of humates and associated with the necessary soil organisms, are valuable forms of food for the oat plant. To what extent the humates are capable of being used by other crops as food yet remains to be determined. It would seem reasonable to suppose that other grain crops are also able to make use of the humates for food purposes."

The humates used in the above experiments were prepared in the following manner:

"Five kilograms of native prairie soil was placed in a large glass bottle and treated with a 1 per cent solution of hydrochloric acid until no reaction for lime was obtained. The acid was then removed by washing with distilled water. A 2 per cent solution of sodium hydrate was then added to the soil to extract the humus. The humus materials were decanted into a large ribbed filter and the extraction continued until the solution was nearly colorless. Dilute hydrochloric acid was then added to the filtered humus extract until the solution was slightly acid. Heat was applied and the humus materials were precipitated, leaving a brownish-yellow liquid from which it was separated by filtering. This precipitated humus material is soluble in hot water and does not separate out upon cooling. The material is washed with a little cold water, in which it is slightly soluble. By dissolving in hot water and reprecipitating, the humus materials can be obtained quite free from chlorin."

Composition of soil humus.—The amount of humus extracted from different soils by alkaline solutions may be very variable, but the amount of nitrogen is as a rule very constant, as the result of examinations of a number of soils reported in this article clearly shows.

The humus materials thus extracted "yield from 5 to 25 per cent, according to the nature of the soil, of a brownish-red ash. This ash is evidently in chemical combination, because if merely soluble in the alkaline solutions used for extraction the mineral matter would not be reprecipitated with hydrochloric acid but would be removed in the filtrate and washing solutions employed."

The average results of 8 analyses of the ash of humus from good pro-

ductive soil yielding 2.5 per cent of precipitated humus materials were: Silica, 61.97 per cent; potash, 7.50; soda, 8.13; lime, 0.09; magnesia, 0.36; ferric oxid, 3.12; alumina, 3.48; phosphoric acid, 12.37; sulphuric acid, 0.98, and carbonic acid, 1.64.

"A number of combustion analyses have been made of the precipitated humus materials obtained in various ways. The carbon ranges from 40 to 65 per cent; the hydrogen from 3.5 to 5 per cent, while the nitrogen ranges from 6 to 10 per cent. The ultimate composition of a few types is given."

Ultimate composition of soil humus.

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Ash.
	Per cent	*Per cent*	*Per cent.*	*Per cent.*	*Per cent.*
Average of 8 soil humates	45.12	3.67	28.60	10.37	12.24
From cultivated soil	48.16	5.40	33.16	9.12	4.16
From new soil	44.12	6.00	35.16	8.12	6.60
From soil of the station farm	50.10	4.80	33.66	6.54	4.90

The general conclusions drawn by the author from his work are as follows:

"(1) The continuous cultivation of grain crops without farm manures or a proper rotation of crops has resulted in a loss from the soil of 30 to 50 per cent of the total decaying animal and vegetable matter known as humates.

"(2) With the loss of the humus from the soil there has been a corresponding loss of nitrogen. For every 1 lb. of nitrogen removed in the crop there has been a loss of 3 or 4 lbs. of nitrogen from the soil by the fermentation of the humus, caused by the continuous cultivation of plowed crops.

"(3) A loss of humus has resulted in decreasing the amount of available phosphates and potash associated with the humus.

"(4) The power of the soil to retain water and withstand drought has been decreased by the loss of humus.

"(5) Decaying animal and vegetable matters, like farm manures, when added to the soil, combine with the soil potash, etc., and produce potassium humate and other compounds. Hence, farm manures are not only valuable for the fertility which they contain, but also valuable in making the inert plant food of the soil more available.

"(6) The humates of potassium, magnesium, iron, and the double humates with phosphorus and sulphur can be utilized by plants as food. Oats have been grown, producing fertile seeds when all of the food was supplied in the form of humates, along with the organisms present in the soil which carry on the work of fermenting the humus.

"(7) The humus and nitrogen of the soil should not be allowed to decrease seriously. Summer fallowing is particularly destructive upon the humus and nitrogen, it temporarily puts the soil in better condition, but in the end gets it out of condition. The use of well-prepared farm manures, and the rotation of crops, in which grass crops and particularly clover, and if necessary green manures, form an important part of the rotation, will prevent the rapid decline of the humus and nitrogen of the soil."

The absorptive power of soils for aqueous vapor and its importance for plants, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 19–35*).—Six different soils were used in experiments on this subject, including coarse sand, medium fertile garden soil, infer-

tile humus sand, sandy loam, very fertile calcareous soil, and peat soil. The amounts of water which these soils would hold when saturated were determined; small amounts of the soils were spread out on small watch glasses and kept in a saturated atmosphere (at 19 to 22° C.) for a week to determine hygroscopicity; and corn and oats were then grown on each to determine the point to which the moisture content could be lowered before wilting occurred. The following results were obtained:

Absorptive power and water requirements of soils.

Kind of soil.	Total water-holding power (per 100 parts of air-dry soil).	Hygroscopic absorption (per 100 parts of dry soil).	Moisture content of soil at which plants began to wilt (per 100 parts of dry soil).
	Per cent.	*Per cent.*	*Per cent.*
Coarse sandy soil	26.5	0.42	1.5
Sandy garden soil	43.9	1.68	4.6
Fine humus sandy soil	41.4	0.97	6.2
Sandy loam	43.3	2.40	7.8
Calcareous soil	38.3	3.65	9.8
Peaty soil	274.0	20.60	49.7

It follows from these results that the water hygroscopically absorbed by soils can be of little benefit to plants, since the latter begin to wilt with a percentage of water in the soil much higher than that furnished by the hygroscopicity of the soil.

To determine whether plants differ from one another in their power to utilize the moisture of the soil determinations were made of the moisture content of different soils at the point when various plants began to wilt. The results were as follows:

Moisture content of soil required by different plants.

Plant.	Moisture content at which plants begin to wilt (per 100 parts of dry soil). On calcareous soil.	On peaty soil.
	Per cent.	*Per cent.*
Oats	8.40	38.2
Barley	9.98	32.3
Rye	9.55	34.8
Wheat	....	33.6
Corn	7.91	....
French rye grass (*Arrhenatherum elatius*)	....	33.2
English rye grass	....	33.1
Meadow foxtail	....	34.2
Soft brome grass	....	32.8
Red clover	10.28	34.3
Sweet peas	8.77	....
Lambs clover	9.24	....
Crimson clover	....	34.1
Alfalfa	8.90	....
Vetch	....	35.3
Esparcet	9.92	....
Fire bean	11.04	....
Horse bean	11.30	....
Potatoes	5.07	41.4

The minimum amount of moisture necessary for the different kinds of plants does not vary very much. The average amount (per 100 parts of dry soil) required by different groups of plants was found to be as follows: In the calcareous soil, 4 cereals, 9.85 parts; 7 Leguminosæ, 10.95 parts; in the peaty soil, 8 cereals, 50.79 parts; 3 Leguminosæ, 52.87 parts.

Amount of water in soils during May and June, 1895, M. WHITNEY (*U. S. Dept. Agr., Division of Agricultural Soils Buls. 1, pp. 16, dgms. 11; 2, pp. 16, dgms. 19*).—Moisture determinations were made in samples of soil received daily from about 50 observers located on typical truck soils of the Atlantic Coast, tobacco soils in the Eastern States, and soils of the western or arid portions of Kansas and Nebraska, and the amount of moisture present each day in the different soils is shown graphically. The method pursued in collecting samples is as follows:

"A small brass tube, about an inch in diameter and 15 in. long, has a thin brass collar inserted in one end to reduce the friction on the inside of the tube. This end is then turned off so as to make a cutting edge. A mark is placed upon the tube 12 in. from this cutting edge. In taking the sample, the tube is driven into the ground to the 12-inch mark, then carefully withdrawn, and a rubber cap put over each end to prevent the soil from drying out. The tube, thus protected, is put into a sack and mailed to this Department, where a moisture determination is made by the usual methods. . . .

"The principal object of this work is to study the relation of soils to water and to keep a record of the amount of moisture maintained in soils adapted to different kinds of crops or in soils under different climatic conditions. It was necessary, in order to have the results strictly comparable, to adopt some uniform kind of treatment, and, as it was impossible to secure exactly the same conditions of cultivation in such widely separated localities, the uncultivated soil, kept free from weeds or vegetation of any kind, was adopted as the standard condition of comparison.

"It was desired, however, to study the effects of different methods of cultivation, especially in the arid portions of Kansas and Nebraska, to test their influence upon conserving this moisture. Duplicate samples were therefore taken in these localities from plats under ordinary conditions of cultivation, from other plats which had been subsoiled and thoroughly cultivated subsequently, and from other plats which had been irrigated in order to study the conditions of moisture maintained where the artificial application of water was practiced. Some of the observers had all of these conditions and others only two or three."

"The records show much of interest, also much which can not be explained until a careful examination is made of the soils from each locality and the relation of the soils to water has been fully determined." The moisture curve is shown to be higher in the typical dark shipping tobacco soil of Newstead, Kentucky, than in the typical bright tobacco soil of Oxford, North Carolina.

"This is due to the closer texture of the soil, and this difference in the conditions of moisture is characteristic of these two soils, and is mainly what gives each its peculiar value."

"The moisture conditions most favorable to the bright tobacco appear to range from 6 to 8 per cent, 10 per cent making the soil rather too wet, while with only 5 per cent of moisture the soil is rather too dry. The dark shipping tobacco land has

maintained on an average about 15 per cent of water, ranging from about 13 to 17 per cent. These conditions were reported as generally favorable to the crop. The soil adapted to the White Burley tobacco maintained on an average about 20 per cent, and varied only from 19 to 21 per cent throughout the month [of June]. The conditions here also were reported as generally favorable to this crop. . . .

"A normal water content of the truck soils appears to be between 5 and 10 per cent, the latter being rather too moist and the former rather too dry for the best development of the truck crops. . . .

"Subsoiling or any deep cultivation should be done a sufficient time before the crop is put in to insure a rain which shall thoroughly moisten the soil; otherwise, the subsoiling may be very prejudicial to the crop. . . .

"The time when it would have its maximum effect would be after a wet season and when a dry period was coming on. The moisture content at this time should fall much more gradually in the cultivated than in the uncultivated land. This is shown to a slight extent in some of the records, but not to such an extent as would seem likely to occur under the most intelligent cultivation of the soil The small amount of data which has been collected is not sufficient, however, to warrant a close and final judgment in this matter. . . .

"At Colby and Scott City [Kansas] the subsoiled field contained considerably less moisture than the field under ordinary cultivation. The reason for this is undoubtedly due to the fact that there had been no rain since the subsoiling had been done, and the act of subsoiling had dried out the ground. Both of these soils absorbed more of the rainfall of May 30 than the soils under ordinary cultivation."

As a rule, soils under ordinary cultivation contained more moisture than sod lands, this being especially true of the Kansas and Nebraska soils, and at 4 places in this region "the irrigated fields contained about 5 per cent more water than the field under ordinary cultivation."

The action of organic and mineral acids upon soils, H. SNYDER (*Minnesota Sta. Bul. 41, pp. 61–67*).—Work in continuation of that published elsewhere[1] is reported. Oxalic and citric acids were used in strengths of 1, 5, and 10 per cent and their solvent effect on different soils compared with that of hydrochloric acid of 1.115 sp. gr. and concentrated hydrochloric, nitric, and sulphuric acids, as well as with the results obtained by the fusion method. The results in general confirm previous conclusions.

Chemical and mechanical analyses of soils, H. SNYDER (*Minnesota Sta. Bul. 41, pp. 32–58, figs. 2*).—To test the accuracy of present methods of chemical analysis of soils the author compares the results of analysis of a composite sample of soil made up of equal weights of 200 different soils with the average of the analyses of the individual soils. The results are as follows:

	Composite sample.	Average.
	Per cent.	*Per cent.*
Potash	0.29	0.28
Soda		0.25
Lime	2.16	2.16
Magnesia		0.55
Iron oxid	2.68	2.68
Aluminia	5.45	5.20
Phosphoric anhydrid	0.27	0.24
Sulphuric anhydrid	0.03	0.03
Carbonic anhydrid	1.15	1.12
Total volatile	7.01	7.00
Total insoluble	79.95	79.51

[1] Jour. Amer. Chem. Soc., 17 (1895), p. 148 (E. S. R., 6, p. 704).

"This is the most severe test to which the method can be subjected. In many cases the results are identical; in other cases the differences are so slight as to be insignificant. It is to be noted that the widest differences, silica and total insoluble matter, fall on those elements which are not absolutely necessary for crop food. The conclusion is, plainly, that as far as the accuracy of the methods of analysis which have been employed is concerned the results will bear very close interpretation."

For agricultural purposes the author divides the soil constituents as determined by chemical analysis into 3 classes:

"(1) Silicates and other compounds of potash, soda, lime, magnesia, phosphorus, etc., which are soluble in the soil water and in dilute organic acids. . . .

"(2) In the second class, the plant food is in a somewhat more insoluble form, and is represented by all of those compounds and silicates which are insoluble in hydrochloric acid of 23 per cent strength, 1.115 sp. gr. . . .

"(3) The third class of silicates in the soil includes all of those compounds which require the combined action of the highest heat and the strongest chemicals and fluxes in order to decompose them."

In the following table is given the amount of mineral constituents in the first and second, and in the third classes for a few soils:

Classification of the mineral constituents in different soils.

	Warren.		Fairhaven.		Holden		Experiment Station.	
	First and second class.	Third class.	First and second class.	Third class.	First and second class	Third class.	First and second class.	Third class.
	Per ct.	*Per ct*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Silica, etc	63.07	....	84.77	....	78 72	....	84.08	....
Potash	0 54	2 18	0.21	3.46	0.35	1.47	0.30	1.45
Soda	0.45	3 55	0.22	2.95	0.13	5.33	0.25	0.25
Lime	2.44	0 36	0.48	0.16	0 23	0.36	0.51	0 35
Magnesia	1.85	0.25	0.34	0.47	0.17	0 54	0.26	0.46
Ferric oxid	4.18	0 78	3 76	0.72	4 15	0.17	2.56	1.07
Alumina	7.89	5 54	6.26	5 44	7.34	6.78	2 99	9.72
Phosphoric anhydrid	0 38	....	0 12	0.08	0 11	0 09	0.23	0.05
Sulphuric anhydrid	0.11	0 24	0.09	0.25	0.03	0 23	0.08	0.02

In order to determine whether the constituents of the third class are of any immediate value as plant food, the following experiment was made:

"The insoluble matter obtained from the analyses of over 300 samples of soil was saved, thoroughly mixed, and then seeded to oats. Inasmuch as all the nitrogen had been removed from the insoluble matter, a small amount of sodium nitrate was added, so that the growth would not be checked for the want of nitrogen. The insoluble residue contained potash, soda, and a limited amount of lime, magnesia, and phosphoric acid, all of which, however, were in the third class of insoluble plant food forms. The total growth produced by the plant plainly indicates that the mineral matter insoluble in hydrochloric acid and designated as the third class of plant food forms is incapable of contributing toward growth."

A general discussion is given of the amount and form of the plant food in soils, particularly those of Minnesota, accompanied by chemical analyses and partial mechanical analyses of 94 samples of Minnesota soils and subsoils from localities in the Red River Valley, and the western, central, and southeastern regions of the State, not reported in

Bulletin 30 of the station (E. S. R., 6, p. 857), and from reclaimed marsh and low lands. Analyses of 7 samples of marls are also reported.

An analysis of alkali soil is included in the above and suggestions are made regarding the improvement of such soils.

"The chemical analyses, taken as a whole, indicate that there are no vitally weak points in any of the soil types of the State. Practical experience corroborates this, inasmuch as no commercial fertilizers are used, except for garden and experimental purposes. There are no fertilizer factories in Minnesota, and the slaughterhouse refuse is practically all sold to fertilizer firms in Chicago and to the eastward. Continuous cropping in one direction and getting the soil out of condition, mechanically and weedy, rather than a scarcity of plant food, will, without doubt, be the first difficulties experienced in many sections of the State."

Idaho soils, their origin and composition, C. W. McCurdy (*Idaho Sta. Bul. 9, pp. 1–28, figs. 2*).—After a brief general discussion of the relations of chemistry, geology, and agriculture, the author treats the origin and composition of soils, the chemical classification of soils, explanations of chemical terms, and physical properties of soils. Chemical analyses of 33 soils, representing 8 counties of the State, are reported, with notes on topographical, geological, and agricultural features of Idaho, and a general classification of the soils of the State.

"The analyses of the soils of Idaho thus far, and of the Pacific Northwest States in general, show them to be rich in phosphoric acid, potash, nitrogen, and iron, together with a sufficient supply of lime."

Soils and their properties, W. Fream (*London: George Bell & Sons, 1895 (2d ed. revised), pp. 176, figs. 21, col. map*).—All that is attempted in this work "is to trace soils back to their parent rocks, to indicate some of their more important physical and chemical properties, and to give a brief account of the distribution of soils within the British Isles. It is proposed to follow this volume with another, in the same series, upon the practical management of the soil."

A simple apparatus for collecting samples of water at various depths, G. C. Whipple (*Science, n. ser., 2 (1895), No. 51, pp. 841, 842, fig. 1*).

Chlorin in rain water (*Agl. Students' Gaz., 1895, Dec., p. 202*).

Sewage-polluted streams, C. B. Cochran (*Agriculture of Pennsylvania, 1894, pp. 181–189*).—Analyses of water of some streams polluted by sewage; and some remarks on the effect of such water on domestic animals, especially cows, and on dairy products, with extracts from correspondence on the latter subject.

Power of soils to resist erosion by water, W. A. Burr (*Irrigation Age, 8 (1895), No. 8, pp. 235, 236*).

Progress in the agricultural chemistry of moor soils and moor culture, B. Tacke (*Chem. Ztg., 19 (1895), No. 95, pp. 2121–2125*).

Reclamation of the moor soils of Dordogne, France, R. Bouilhac (*Compt. Rend., 121 (1895), No. 19, pp. 662–664; Ann. Agron., 21 (1895), No. 11, pp. 509–516*).—The sterility of these soils was found to be due principally to a deficiency of phosphoric acid.

Practical value of chemical and physical examinations of soils and the preparation of soil charts, R. Heinrich (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 82–95, chart 1*).

On soil taxation, R. Heinrich (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 72–81*).

The accumulation of copper compounds in the soil, A. Girard (*Ind. Lait., 20 (1895), No. 25, pp. 195, 196*).

On the amount of water in the soil during the extreme drought of 1894, N. PASSERINI (*Staz. Sper. Agr. Ital., 28 (1895), No. 10, pp. 607–613*).

The water capacity and permeability of soils to air, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 40–72*).

The soils of northeastern Iowa, their history and genesis, S. CALVIN (*Iowa Weather and Crop Service, 1895, Nov., pp. 7–9*).

The soils of Michigan, R. C. KEDZIE (*Michigan Sta. Rpt. 1893, pp. 403–415*).—A reprint of Bulletin 99 of the station (E. S. R., 5, p. 286).

Analyses of Malmesbury (Cape Colony) soils (*Agl. Jour. Cape Colony, 8 (1895), No. 19, pp. 480, 481*).—Results of analyses of 22 samples are tabulated and discussed.

Analysis of Colonial soils, J. MULLER (*Agl. Jour. Cape Colony, 8 (1895), No. 24, pp. 621–624*).

FERTILIZERS.

Note on the use of superphosphate, J. JOFFRE (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 13, pp. 698–703*).—In a previous paper the results of laboratory experiments were reported which indicated that to some extent the soluble phosphoric acid of superphosphates is directly absorbed by plants. The present article gives results of experiments in the same line in the field. Beets were planted in an upland soil mixed with a certain amount of sand, to which superphosphate was added at the rate of 1,000 kg. per hectare as a top dressing. Plants were pulled up at frequent intervals, carefully cleaned, and tested for phosphoric acid.

The superphosphate was applied July 3. At that time the small beet plants contained in the green state 0.72 part of phosphoric acid per 1,000 parts, which had been derived from the seed and from the soil in which the plants were growing. Six days later, July 11, the beets contained 1.62 parts per 1,000 of phosphoric acid; July 21, 2.14 parts. It is true that the absorption of phosphoric acid is slight, representing a very small fraction of the quantity of soluble phosphoric acid applied to the soil. Still it may have been of considerable influence on the development of the plant, since it was supplied at the critical period at which the reserve material of the seed had been exhausted and when it would have been necessary for the plant to take up very large quantities of water in order to obtain from the soil the phosphates necessary for its growth.

Plants examined August 13 contained only 1.09 parts per 1,000 of phosphoric acid, due to the fact that the phosphate had become insoluble and the beets had developed to such an extent that the percentage of phosphoric acid would naturally diminish; but it should be observed that the assimilation of phosphoric acid suddenly fell off at the same time that the phosphate in the soil became insoluble.

The success in growing plants in pure sand in which the superphosphates did not revert confirmed the above results in indicating that water-soluble combinations of phosphoric acid are directly assimilated by plants.

In order to compare the effect of insoluble phosphate with that of superphosphates bone ash was applied to a soil similar to that used in experiments with superphosphate, under very favorable conditions and in sufficient quantity to insure that every root came in contact with a fragment of the phosphate. Notwithstanding these favorable conditions, plants analyzed on July 21 showed only 1.87 parts of phosphoric acid per 1,000, as against 2.14 parts for plants grown with superphosphate. Moreover, this assimilation of phosphoric acid is explained by the rapid transpiration of water by the plants and by the fact that the phosphate used was not entirely insoluble.

It appears, therefore, that the beneficial effect of superphosphates is not due entirely to the thorough dissemination of phosphoric acid in the soil which is obtained by the use of this substance, but also to the fact that this soluble phosphoric acid is directly absorbed by plants.

The observations of Schlössing and Prunet[1] that fertilizers applied in rows, in which they are less liable to become insoluble, produce a greater effect than when intimately mixed with the soil, confirm the conclusions from the above experiments.

In the use of phosphates, therefore, it is necessary, in order to obtain maximum results, to distinguish between 2 kinds of soil, (1) soils such as those of Brittany (peaty), which decompose insoluble phosphates and which therefore respond profitably to applications of ground phosphates, and (2) those soils, which are by far the more numerous, on which applications of soluble phosphates are absolutely indispensable.

On the relation of water-soluble phosphoric acid to the absorbent constituents of the soil, M. GERLACH (*Landw. Vers. Stat., 46 (1895), No. 2-3, pp. 201-219; abs. in Jour. Chem. Soc., 1895, Dec., p. 521*).—It is pointed out that iron oxid and alumina and calcium and magnesium carbonates seize upon and hold phosphoric acid in the soil, but that combinations of the latter are dissolved with comparative ease. They dissolve to some extent in water and may be completely dissolved in carbonic acid water. On the other hand, the former are insoluble in pure water and water charged with carbonic acid, but are partially or completely dissolved after long digestion in weak solutions of organic acids, the more insoluble being the iron phosphates.

The reactions which take place when a mixture of calcium phosphate and iron or aluminum hydrates is acted upon by carbonic acid water may be expressed by the following formulas:

(1) $2CaHPO_4+Fe_2(OH)_6+XCO_2=2CaH_2(CO_3)_2+2FePO_4+(X-4)CO_2+2H_2O$.

(2) $2CaHPO_4+Al_2(OH)_6+XCO_2=2CaH_2(CO_3)_2+2AlPO_4+(X-4)CO_2+2H_2O$.

Under such conditions we see that a basic iron or aluminum phosphate may be formed.

Stoklasa[2] has shown that superphosphates contain free phosphoric

[1] Compt. Rend., 115 (1892), p. 698; 118 (1894), p. 653 (E. S. R., 5, p. 1091).

[2] Mitt Ver. Förd. landw. Versuchw. Oesterr. 1893, II, No. 8, p. 140 (E. S. R., 5, p. 1015).

acid and monocalcium phosphates. When, therefore, superphosphates are applied to the soil these compounds are seized by the absorbent constituents of the soil, such as the carbonates of lime and magnesia and the oxids of iron and aluminum, and converted into less soluble phosphates. The phosphates of lime and magnesia are soluble to some extent in water, more soluble in salt solutions, and still more soluble in water containing carbonic acid and humus acids. Carbonic acid water is, however, almost without effect on iron and aluminum phosphates. In fact 1 per cent acetic acid has no effect on iron phosphate and dissolves only traces of aluminum phosphate. Stronger solvents than the latter are not likely to be found in ordinary soils, so that it is safe to say that the phosphates of iron and aluminum are entirely insoluble or are dissolved to only a slight extent in the soil solutions.

Mineral phosphates as fertilizers, H. W. WILEY (*U. S. Dept. Agr. Yearbook 1894, pp. 177-192, figs. 2*).—The different kinds of phosphates, including apatites, coprolites, and various forms of phosphate rock are described, with a brief discussion of the constituents of phosphate rock. Information is also given regarding the cost of phosphatic fertilizers to the farmer, what is meant by "available phosphoric acid," the nature and use of superphosphates or acid phosphates and basic slag, the adulteration of basic slag, the phosphates in marl, the direct application of natural phosphates, and the application of phosphatic fertilizers in general.

Fertilizers and the ferments of the soil, P. P. DEHÉRAIN (*Les Engrais et les Ferments de la Terre. Paris: Rueff et Cie, 1895, pp. 222*).—In this volume papers which first appeared in *Revue des Deux-Mondes* during 1893 and 1894 are published, with the extensions and modifications rendered necessary by the almost daily developments in this department of agricultural science.

The primary objects of the work are stated to be to review concisely the history of the use of fertilizers and to present in simple language the present status of the fertilizer question. The volume is divided into 2 parts of 2 chapters each.

Chapter 1, part 1, is devoted to organic fertilizers, including brief preliminary discussions of the causes of the agricultural crisis and the principles of plant nutrition, and dwelling at some length on the importance of barnyard manure as the basis of all rational fertilization of the soil. There are also paragraphs on night soil, tankage, blood, leather, wool waste, guano, sulphate of ammonia, nitrate of soda, oil cakes, and green manures.

Chapter 2 of this part deals with mineral fertilizers, including lime, plaster, phosphates, and potash fertilizers, and discusses fraud in fertilizers, and the use of chemical fertilizers.

Chapter 1 of part 2 is devoted to the fixation of nitrogen in the soil and discusses pathogenic ferments of the soil, the enrichment of permanent meadows in nitrogen, and the fixation of atmospheric nitrogen in the soil by microörganisms.

The subject of chapter 2 of part 2 is the utilization of the nitrogen of the soil and explains the necessity for nitrogenous fertilizers, the origin and fixation of humus, nitrogen assimilation by Gramineæ and Leguminosæ, transformation of humus, nitrification and the loss of nitrates in the drainage, and the philosophy of fallow crops.

It is believed that the work will be found interesting to students of agriculture on account of its historical features, and suggestive and helpful to investigators on account of its clear statements of the results of very recent researches, especially in the lines of the fixation, transformations, and utilization of the nitrogen in the soil.

On pigeon manure, B. SCHULZE (*Landwirth, 1895, p. 301; abs. in Chem. Centbl., 1895, II, No. 25, p. 1129*).—The value of pigeon manure is stated to depend in large

degree upon the moisture and sand content. The author analyzed 40 samples, with the following average result: Water 21 per cent, nitrogen 2.53, phosphoric acid 1.79, potassium oxid 1.46. The sand content was as high as 43.3 per cent.

The nitrogen question according to the most recent publications, E. HASELHOFF (*Deut. landw. Presse, 22 (1895), No. 84, pp. 759–761*).—A discussion of the loss of nitrogen by stable manure.

On the use of chemicals to conserve stable manure, ULLMAN (*Fühling's landw. Ztg., 44 (1895), No. 19, pp. 607–609*).—A summary.

The preservation of stable manure, A. MÜNTZ (*Deut. landw. Presse, 22 (1895), Nos. 89, pp. 808, 809; 90, p. 817; 91, pp. 825, 826*).

The importance of packing in the preservation of manure, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 239–242*).—These experiments were inconclusive, but investigation in this line is to be continued.

Effect of allowing manure to remain under animals on the availability of the phosphate of lime, N. GUINAPIN (*Jour. Agr. Prat., 59 (1895), No. 45, pp. 671, 672*).

Castor-bean cake as a fertilizer, MAIZIÈRES (*L'Engrais, 10 (1895), No. 51, pp. 1213, 1214*).

Oil cakes as fertilizer, MAIZIÈRES (*L'Engrais, 10 (1895), No. 52, pp. 1235, 1236*).

On the manurial value of the offal of slaughterhouses and cattle yards, J. H. VOGEL (*Deut. landw. Presse, 22 (1895), Nos. 101, p. 919; 102, p. 930*).

The soft phosphate of Florida, its nature and its agricultural value, W. FREAR (*Agriculture of Pennsylvania, 1894, pp. 162–167*).—A description of this phosphate and a brief summary of results of experiments with different natural phosphates by a number of experiment stations.

Report on the phosphates of Algeria, MASTIER (*L'Engrais, 10 (1895), No. 48, pp. 1142–1147*).

The phosphates of Tunis and Algeria (*Rev. Sci., ser. 4, 4 (1895), No. 21, pp. 652–656, fig. 1*).

The phosphates of lime of Algeria and Tunis, H. HITIER (*Jour. Agr. Prat., 59 (1895), No. 49, pp. 807–812*).

The rôle of lime in fertilizers, S. GUÉRARD DE LAHARPE (*Jour. Agr. Prat., 59 (1895), No. 47, pp. 741, 742*).

The search for marl beds in North Germany, and an investigation of the same, K. KEILHACK (*Deut. landw. Presse, 22 (1895), Nos. 94, p. 851; 95, pp. 861, 862*).

On the variability in the composition of superphosphates and on the formation of hydrofluoric acid in superphosphates, A. CASALI (*Staz. Sper. Agr. Ital., 28 (1895), No. 8, pp. 509–512*).

Calcination of phosphates to render them more soluble, D. LEVAT (*L'Engrais, 10 (1895), No. 45, pp. 1071, 1072*).—A patented process.

Remarks on the purchase and use of mineral fertilizers, L. GRANDEAU (*Jour. Agr. Prat., 59 (1895), No. 45, pp. 649–652*).

Cyanate of calcium, a new nitrogenous fertilizer, C. FAURE (*Compt. Rend., 121 (1895), p. 463; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 329*).

Concerning the scientific work of the Agricultural Institute at Göttingen, LIEBSCHER (*Fühling's landw. Ztg., 44 (1895), No. 18, pp. 561–568*).—A brief summary of experiments in green manuring with leguminous plants and fertilizer experiments on soils of different composition.

Experiments on the most economical application of fertilizers to the soil, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 251–261*).—These include experiments with nitrogenous and phosphatic fertilizers.

How deep shall manure be plowed under? R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 242–251, pl. 1*).—The experience of the station indicates that with both commercial fertilizers and stable manure it is best to attempt to secure as complete a mixture as possible of the manures with the whole surface soil.

Recent experiments concerning the effect of peat moss on Thomas slag, E. BRAUN (*Fühling's landw. Ztg., 44 (1895), No. 19, pp. 605–607*).

Fertilizer experiments with different kinds of phosphates for marsh lands during 1894, C. VON FERLITZEN (*Svenska Mossk. Fören. Tidskr., 1895, pp. 199-210*).

Analyses of commercial fertilizers, W. G. GARRARD and C. G. HOPKINS (*Illinois State Bd. Agr. Rpt., 1892, 1893, 1894, pp. 13*).—This includes the text of the State fertilizer law, an article on the nature and use of fertilizers, and analyses and valuations of 20 samples of commercial fertilizers examined during the years 1892 and 1893.

Analyses of commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Bul. 56, pp. 59-72*).—This includes brief explanations of terms used in fertilizer analyses, notes on valuation and on the importance of analysis of fertilizers, and tabulated analyses and valuations of 120 samples of commercial fertilizers.

Inspection of commercial fertilizers, R. C. KEDZIE (*Michigan Sta. Rpt. 1893, pp. 384-396*).—A reprint of Bulletin 97 of the station (E. S. R., 5, p. 290).

Analyses of commercial fertilizers, W. L. HUTCHINSON (*Mississippi State Chemist, Bul. 8, p. 17*).—Notes on valuation and tabulated analyses and valuations of 172 samples of commercial fertilizers.

Analyses of commercial fertilizers, W. FREAR (*Agriculture of Pennsylvania, 1894, pp. 377-398*).—Notes on valuation and tabulated analyses of samples of commercial fertilizers collected in Pennsylvania from August 1, 1894, to January 1, 1895.

Fertilizer valuations, W. FREAR (*Agriculture of Pennsylvania, 1894, pp. 217-222*).—Various suggestions regarding the valuation of fertilizers in Pennsylvania.

Fertilizer brands and their meaning, T. J. EDGE (*Agriculture of Pennsylvania, 1894, pp. 253-275*).—The desirability of a uniform system of naming fertilizers is explained and the character of the goods sold under the following names is discussed in detail: Ground bone, South Carolina rock, alkaline fertilizers, dissolved animal bone, and complete fertilizers.

The results of the fertilizer control of Riga, Russia, 1894-'95, G. THOMS (*Die Ergebnisse der Dünger-Kontrole, 1894-'95, pp. 58*).—This includes data on the imports of fertilizers, the composition of phosphates (superphosphate, Thomas slag, and ground phosphorite), nitrogenous superphosphates, potash salts, nitrogenous fertilizers, and poudrette; and a review of progress in the fertilizer industry during 1894 and 1895 in the following lines: Experiments with phosphate of potash, the trade in phosphatic fertilizers, bacteriology of manure, the preservation and management of barnyard manure, utilization of the nitrogen of barnyard manure, and legislation relating to the trade in commercial fertilizers.

FIELD CROPS.

Analyses of Russian barley, V. STEIN (*Royal Danish Agl. Soc. Rpt., 1894-'95, pp. 100-107*).—Seventeen samples of barley imported from Russia were examined as to purity, weight, chemical composition, etc. The average purity was 96.43 per cent, the limits being 93.86 and 97.92 per cent. The samples contained from 0.55 to 2.54 per cent of weed seeds. The results of complete botanical and chemical analyses are given. The water-free substance of the samples contained 13.30 to 16.62 per cent of crude protein, 2.25 to 2.42 per cent of ether extract, 62.09 to 67.44 per cent of nitrogen-free extract, 11.97 to 16.11 per cent of crude fiber, and 3.38 to 4.87 per cent of ash. The average composition was ash 3.90 per cent, crude protein 14.99, crude fiber 14.14, nitrogen-free extract 64.65, and ether extract 2.32. If the relative value of protein, fat, and carbohydrates be placed as 3:3:1, the number of food units calculated for barley containing 12 per cent of water was 101,08, the figures ranging between 95.44 and 105.12.—F. W. WOLL.

Grasses as sand and soil binders, F. LAMSON-SCRIBNER (*U. S. Dept. Agr. Yearbook 1891, pp. 421–436, pl. 1, figs. 10*).—The grasses discussed at greatest length are the following: Marram grass (*Ammophila arenaria*), upright sea lyme grass (*Elymus arenarius*), rolling spinifex (*Spinifex hirsutus*), St. Augustine grass (*Stenotaphrum americanum*), Louisiana grass (*Paspalum compressum*), coast couch grass (*Zoysia pungens*), bitter panic grass, long-leafed sand grass (*Calamovilfa longifolia*), water oats or beach grass, Redfield's grass (*Redfieldia flexuosa*), and salt or alkali grass.

Windrowed vs. standing cane, W. C. STUBBS (*Louisiana Stas. Bul. 37, 2d ser., pp. 1290–1328*).

Synopsis.—This article gives the results of 3 years' work in comparing early-cut, late-cut, and windrowed sugar cane, with a view to ascertaining some means of prolonging the grinding season. When no frost occurred before the working of the windrowed and late-cut canes, windrowing resulted in a heavy loss both as to quality and quantity of crop. In the absence of a forecast of an approaching freeze, windrowing before the middle or last of December is regarded as scarcely justifiable. Windrowing just before a freeze is preferred to windrowing just after a freeze. After a bud-killing freeze, windrowing is preferred to leaving the cane standing, or if inexpedient, topping should be practiced. After a splitting freeze, windrowing is not recommended. The usual method of windrowing cane intended for seed is not advised with cane for the mill. Partial burning of a field of standing cane reduced the yield of sugar about 25 per cent.

The experiments, 222 in number, were conducted in 1892, 1893, and 1894. In each experiment there were at least 3 rows, one of which was left standing until late in the season; the other two were cut together earlier, one row being worked up immediately, while the other was windrowed, i. e., cut down with its adhering leaves and so placed in the middle of the row that the tops completely covered the butts. The windrowed cane was worked on the same day as the late-cut cane, or a few days later.

Canes windrowed before a freeze and harvested before a freeze (pp. 1293–1300).—Under this head 2 separate experiments were conducted. In the first, taking the early-cut cane as a standard, cane left standing until December 9 gained 1.65 tons and that left in windrow 35 days from November 7 lost 4.39 tons per acre. In the second experiment late cutting (December 15) afforded a gain of 1.23 tons of cane per acre, and windrowing for 38 days from November 9 resulted in a loss of 2.77 tons.

Sugar per acre from early-cut, late-cut, and windrowed cane.

	Sucrose.	Glucose.	Solids not sugar.
	Pounds.	*Pounds.*	*Pounds.*
First experiment:			
Cut November 7	5,127	954	851
Cut December 9	6,744	618	484
Windrowed 35 days	3,666	1,215	902
Second experiment:			
Cut November 9	5,354	1,116	634
Cut December 15	6,272	628	648
Windrowed 38 days	3,766	1,410	855

Taking the early-cut cane as a standard and allowing for the "melassigenic" influence of glucose, the increased sugar per acre from late cutting is estimated at about 64 lbs. per ton in the first experiment and 1,407 lbs. per acre in the second experiment. Sugarhouse results showed that late-cut cane afforded 49.8 or 34 lbs. of sugar per ton of cane more than early cutting, and the latter treatment afforded 47.7 or 51.5 lbs. of sugar per ton more than windrowing.

Canes windrowed before a freeze and harvested soon after a freeze (pp. 1300–1302).—A killing frost occurred December 27, but the cane was not split. Canes left standing until January 2 yielded 1.21 tons per acre more than early-cut cane and 1.42 more than cane windrowed for 42 days.

Sugar per acre from cane cut before and after a freeze.

	Sucrose.	Glucose.	Solids not sugar.
	Pounds.	*Pounds.*	*Pounds.*
Cut November 22	5,622	794	640
Cut January 2	6,058	580	758
Windrowed 42 days	4,977	1,143	692

"The increase in sucrose [of late-cut over early-cut cane] is 436 lbs. per acre, with a loss of 214 lbs. of glucose, which would increase the available sugar in the sugarhouse by at least this quantity. The 'windrow' compared with the 'early' loses 645 lbs. sugar and gains 349 lbs. glucose, which would decrease the available sugar in our factories by fully this quantity, thus showing a loss of nearly 1,000 lbs. of sugar per acre by windrowing."

The gain of sugar secured in the sugarhouse from late-cut cane was 7.5 lbs. per ton over early cut and 38.5 lbs. per ton over windrowed.

Canes windrowed immediately before and immediately after a freeze (pp. 1303–1307).—On the night of December 4, 1893, the thermometer registered 29° F., the cold killing the bud of the cane but not splitting the stalk. The day before the freeze one portion of a cane field was cut and worked, another portion cut and windrowed, while a third portion was left standing. The day after the freeze the remaining portions of the field were treated as on the preceding day. The late cut and windrowed canes were worked January 17 and 19.

Sugar per acre from cane cut and windrowed before and after a freeze.

	Sucrose.	Glucose.	Solids not sugar.
	Pounds.	*Pounds.*	*Pounds.*
Cut December 4, before freeze	6,576	639	702
Cut January 17	6,313	643	1,251
Windrowed December 4, before freeze	5,742	760	958
Cut December 5, after freeze	6,206	738	669
Cut January 17	5,465	890	903
Windrowed December 5, after freeze	5,678	880	946

"Comparing windrowing immediately before a freeze and windrowing immediately after a freeze, . . . the benefits are slightly on the side of windrowing immediately before the freeze. This is also a protection against a splitting freeze which subsequent windrowing fails to protect."

The sugarhouse results are not detailed.

Canes windrowed after a bud-killing freeze (pp. 1307–1313).—The canes were killed but not split by a temperature of 21° F. on December 26, 1892. December 28 two-thirds of the plat was cut for (1) immediate working or (2) for windrowing. The remainder stood until January 18. There were 2 varieties and 2 widths of rows in this experiment, but "no positive conclusions can be drawn as to the effect of width of rows and variety on the canes left standing or put in windrows."

Averaging all these results the amount of sucrose, glucose, and solids not sugar are given in the following table:

Sugar per acre from cane cut after a bud killing freeze.

	Sucrose	Glucose.	Solids not sugar.
	Pounds	*Pounds*	*Pounds.*
Cut December 28	7,507	1,078	621
Cut January 18	6,492	1,103	871
Windrowed 24 days	6,398	1,240	1,018

"Here the weather was rather favorable to the preservation of the cane, and yet both windrow and late lost heavily."

In the sugarhouse the early cut yielded per ton of cane 26 lbs. more than the late cut and 31.5 lbs. more than the windrowed.

A somewhat similar experiment was made in 1893. The bud of the cane was killed by cold December 4. December 7 the canes on a portion of the plat were cut for the mill and on another portion for windrowing. The late-cut cane stood until January 22. Of the late-cut or standing canes half were topped and the remainder left without topping.

Sugar per acre from cane cut after a bud-killing freeze.

	Sucrose	Glucose.	Solids not sugar.
	Pounds	*Pounds.*	*Pounds.*
Cut December 7	9,060	1,881	937
Cut January 22	6,812	1,149	1,269
Windrowed 50 days	7,689	1,118	1,320

Cane was better preserved in windrow than when left standing.

The following table gives the amounts of sucrose, glucose, and solids not sugar in late-cut canes topped after a freeze, and not topped:

Sugar per acre from topped and untopped cane.

	Sucrose.	Glucose.	Solids not sugar
	Pounds.	*Pounds.*	*Pounds.*
Topped after a freeze	6,830	1,114	999
Not topped	6,762	1,254	1,504

"It will be seen that topping the cane immediately after the freeze has been beneficial. It appears that fermentation starts at the killed bud and gradually proceeds down the cane. By removing the top this fermentation is prevented.

"If cane be left standing after a freeze (which has killed the bud but has not split the stalk) it is advisable to top at once. After such a freeze, topping may sometimes be a good substitute for windrowing in the preservation of the cane."

Sugarhouse results indicated for early-cut cane a gain of 27.5 lbs. of sugar per ton of cane over windrowed and of 40 lbs. per ton over late-cut cane.

Canes windrowed after a splitting freeze (pp. 1313–1318).—A splitting freeze occurred December 27, 1894. The principal results of cutting December 28 or 30, cutting January 14 or 16, and windrowing December 28 or 30 are given in the following table:

Sugar per acre from cane cut after a splitting freeze.

	Sucrose	Glucose	Solids not sugar
	Pounds	*Pounds*	*Pounds*
Cut December 28	7 516	901	1,040
Cut January 14	5 227	778	1 736
Windrowed 20 days	6 451	1 171	2 029
Cut December 30	6 873	1 333	926
Cut January 16	4 095	1 022	919
Windrowed 18 days	5 845	1 107	739

Cane in windrows suffered somewhat less than that standing. "Both were so badly injured that they were unprofitable in a sugarhouse."

Windrowing for seed (pp. 1318–1324).—This, the usual process of preserving cane for seed, consisted in covering the prostrated canes with earth. These experiments extended over 4 years. The amounts of sucrose, glucose, and solids not sugar per acre in cane worked immediately after cutting and after windrowing for seed are shown in the following table:

Sugar per acre from cane worked immediately or windrowed for seed.

	Sucrose	Glucose	Solids not sugar
1892	*Pounds*	*Pounds*	*Pounds*
Cut and worked November 17	5 222	832	543
Windrowed for seed November 17 and worked January 23, 1893	4 603	847	603
1893			
Cut and worked November 20	3 742	435	349
Windrowed for seed November 20 and worked January 29, 1894	3 673	470	667
1894			
Cut and worked November 19	4 936	870	540
Windrowed for seed November 19 and worked January 21, 1895	2 940	648	795

In the sugarhouse results "the theoretical yields have been well sustained by actual results before windrowing; whereas after the cane has been long in windrow the sugarhouse results have been unable to obtain anything approaching theoretical results."

Cane which was partially burned over October 17 and harvested about a month later lost about 25 per cent of its sugar.

In experiments in 1888, ensiling cane proved a failure, the sugar being converted into alcohol and acetic acid.

The loss in weight of grain from lodging, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 174–176*).—Spring sown rye was badly lodged about 5 weeks before the date of harvesting. When ripe the dry weight of 100 ears of standing rye was 92.1 gm., of lodged rye 52.1 gm. The weights of the individual grains on the standing and lodged plants were as 100 : 70. It was noted that the grain on the lodged plants contained a much lower percentage of water than normally ripened kernels. The author suggests that the lodging interferes with or entirely prevents the translocation of materials from the leaves and stems to the grain; consequently, the time when the injury occurs has much to do with the extent of the loss from lodging.

Influence of the time and method of harvesting on the quality of barley intended for malting (*Ibs in Braunschw landw Ztg, 63 (1895), No 39, p 164*)

Notes on Egyptian crops—barley G P FOADEN (*Cairo Boehme and Anderer, 1895, pp 12*) —A comprehensive treatise on the cultivation of barley under irrigation in Egypt

Comparative trials with different varieties of barley 1889–94 B LARSEN (*Tidskr norske Landbr (1895) pp [illegible] 9*) —A summary of results obtained with 28 different varieties of barley in culture trials conducted during 1889 to 1894, inclusive

A new system for the varieties of barley, A ATTERBERG (*Kgl Landt Akad Handl Tidskr, 34 (1895), pp [illegible]–42*)

An experiment on the decrease in weight with beets stored in a cellar R HEINRICH (*Zweiter Ber landw Vers Stat Rostock, 1894 p 2[illegible]0*)

Culture trials with clover and timothy varieties in 1894, B LARSEN (*Tidskr norske Landbr, 2 (1895), pp [illegible]–2[illegible]9*)

Indian corn culture, C S PLUMB (*Chicago Breeders' Gazette Print, 1895, pp 238, figs 69*) —As stated in the author's preface, this volume is largely a compilation It is essentially a summary of the work of the American experiment stations on Indian corn, but includes valuable information from other sources A chapter is given to each of the following topics Historical notes, botanical characteristics varieties and their adaptation, the seed, manures and fertilizers, tillage, planting, harvesting, rotation of crops, insects, diseases, chemical composition and digestibility, the feeding of live stock, soiling, silos and silage, statistics, miscellaneous subjects, and literature on Indian corn

In the chapter on varieties, 27 tested varieties of field corn, besides 14 of sweet corn and 5 of pop corn, are described in some detail, and for some of these there are figures showing the chief characteristics of ear and kernel For 20 States lists of varieties, which at as many experiment stations have afforded highest yields, are given

After making special mention of the results of fertilizer tests in Connecticut, Massachusetts, Georgia, Ohio, Kentucky, Virginia, and Rhode Island, the author gives the following summary of fertilizer tests on corn conducted by the American experiment stations 'Wherever used, stable manure was productive of good results Combinations of nitrogen, potash, and phosphoric acid gave satisfactory yields in many cases, but generally the cost of these was too much to make their use profitable. The value of phosphoric acid was especially shown in tests in Alabama, Louisiana, Pennsylvania, and Vermont, that of nitrogen in Georgia, Massachusetts (local), New York, and North Louisiana, that of potash in Kentucky, New Hampshire, and Massachusetts (general) " This serves to indicate how far we are from a

knowledge of the fertilizer requirements of corn grown on different soils. While further data on this subject are imperatively needed, yet it is believed that a careful digestion of the results already on record would teach us many practical lessons beyond those contained in the above quotation.

Many will question the author's statement that drilled corn "may require less labor in hoeing than will that planted in hills." The discussion of listing corn in the West, and of corn harvesters and shredders will answer the needs of many now interested in these subjects.

The book will be found very useful, for it brings together experimental results not easily obtainable elsewhere by the general reader. If it has deficiencies, they are chiefly due to the insufficiency of the data available for compilation. In subsequent editions, when additional data shall have accumulated, a more thorough digestion of experimental results will probably be feasible.

Flat pea, O. CLUTE (*Michigan Sta. Rpt. 1893, pp. 124-128*).—A reprint from Bulletin 91 of the station (E. S. R., 4, p. 814).

Investigations of Swedish fodder plants, III, A. G. KELLGREN and L. F. NILSON (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 67-179*).—The river valleys of northern Sweden have long been noted for their luxuriant plant growth. The present paper is the third report published by the authors of their investigations of the economic flora of this region (E. S. R., 4, pp. 768, 971). As before, this investigation covered a complete botanical-chemical study of the plants serving as food for farm animals found in the given locality. A large number were sedges and rushes from the bottom lands along the rivers. Very few of the plants reported upon in this paper are of economic importance in this country.—F. W. WOLL.

The culture of lupines in Morbihan, L. GRANDEAU (*Jour. Agr. Prat., 59 (1895), No. 46, pp. 689-691*).—A popular article.

Observations on Medicago media, F. HY (*Jour. Bot. France, 9 (1895), No. 23, pp. 429-432*).—A botanical study on the position of this species in relation to *M. sativa* and *M. falcata*.

The maintenance of natural meadows, G. FOUQUET (*L'Engrais, 10 (1895), No. 29, p. 689*).

A fertilizer test on a natural meadow, F GHIZI (*Staz. Sper. Agr. Ital., 28 (1895), No. 10, pp. 614-620*).

Fertilizer experiments on meadows (*Landw. Centbl. Posen, 23 (1895), No. 44, pp. 261, 262*).

The action of the salts of lime and potash in the vegetation of meadows, E. MER (*Ann. Agron., 21 (1895), No. 6, pp. 270-289; L'Engrais, 10 (1895), No. 35, p. 831*).

On the palatability of hay from meadows fertilized with potash salts, VON NORDENFLYCHT (*Deut. landw. Presse, 22 (1895), No. 96, p. 871*).

Irrigation of meadows in Vaucluse and experiments in manuring natural and artificial meadows, E. ZACHAREWICZ (*Prog. Agr. et Vit., 12 (1895), No. 52, pp. 681-684*).

Chemical composition of light and heavy oats, R HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 206-213*).—The average protein content of the light and of the heavy oats in 3 varieties was practically identical. The light oats contained more fiber and less carbohydrates. The author considers that there is no great difference in the feeding value of light and of heavy oats.

Fertilizer experiments with Thomas slag and kainit for oats on light marsh soil, PETERSEN (*Landw. Blatt Oldenburg; Landw. Wochenbl. Schles. Holst., 45 (1895), No. 45, pp. 628, 629*).

Variety tests of oats, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 190, 191*).—Tabulated data for 7 varieties, most of them tested for several years.

Culture trials with varieties of oats and barley during 1894, B. LARSEN (*Tidskr. norske Landbr., 2 (1895), pp. 318-329*).

Potatoes, amounts of seed, P. M. HARWOOD and P. G. HOLDEN (*Michigan Sta. Rpt. 1893, pp. 146–191*).—A reprint of Bulletin 93 of the station (E. S. R., 5, p. 180).

Yield and starch content of varieties of potatoes, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 177–183*).—Tabulated data give the yield, specific gravity, starch content, and percentage of dry matter in 18 varieties of potatoes tested between 1875 and 1892.

Experiments on the decrease in weight with potatoes stored in a cellar, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, p. 229*).

The potato in field and garden, W. J. MALDEN (*London: W. A. May, 1895*).

Potatoes, L. R. TAFT, H. P. GLADDEN, and R. J. CORYELL (*Michigan Sta. Rpt. 1893, pp. 107–117*).—A reprint from Bulletin 90 of the station (E. S. R., 4, p. 817).

Potatoes, P. M. HARWOOD (*Michigan Sta. Rpt. 1893, pp. 357–370*).—A reprint of Bulletin 95 of the station (E. S. R., 5, p. 183).

On the culture of potatoes in granitic soils, A. CADORET (*Prog. Agr. et Vit., 12 (1895), No. 48, pp. 577–579*).—A statement is given of the greatly increased yield following the application of fertilizers, with good culture, on the sandy granitic soil of the Department of Ardeche, France.

Potato culture in India, P. C. DE (*Indian Agr., 20 (1895), No. 12, p. 371*).

Facts concerning ramie, C. R. DODGE (*U. S. Dept. Agr. Yearbook 1894, pp. 443–460, pls. 2, figs. 5*).—The author treats the subject under the following heads: History and description; the industry in America; comparison of ramie and flax; methods of decortication; climate, soil, and culture; harvesting the crop; yield of ramie; extracting the fiber, and afterprocesses and manufacture. "Briefly summarizing the situation, the outlook is most hopeful."

Variety tests of rye, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 184–189*).—Tabulated data for varieties tested from 1877 to 1888 are given.

Analyses of tubers of Stachys tuberifera, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, p. 224*).

Spurry, O. CLUTE (*Michigan Sta. Rpt. 1893, pp. 118–123*).—A reprint from Bulletin 91 of the station (E. S. R., 4, p. 821).

Observations on the culture of sugar beets on light soil, F. SCHIRMER (*Fühling's landw. Ztg., 44 (1895), No. 20, pp. 641–644*).—An account of an experiment in which yellow lupine, vetch, peas, and other plants were used as green manures for sugar beets. The largest yield was obtained after yellow lupines.

Researches on beets, H. VON VOGELFANG (*Deut. landw. Presse, 22 (1895), No. 85, pp. 774–776, fig. 1*).—An account of laboratory investigations at Eckendorf in the winter of 1894–'95.

A study of sugar beets and their sugar content, C. PFEIFFER (*Inaug. Diss. Leipzig, 1895, pp. 84; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 6, pp. 175, 176.*)

Comparative tests of sugar cane, J. H. WAKKER (*East. Java Expt. Sta. Bul. 18, n. ser., pp. 15*).

The characteristics of typical varieties of sugar beets, J. SCHNEIDER (*Chem. Ztg., 19 (1895), No. 76, p. 1701*).

On the accumulation of sugar in the roots of sugar beets, L. MAQUENNE (*Compt. Rend., 121 (1895), No. 23, pp. 834–837*).

Concerning tobacco planting in Borneo and Sumatra, J. F. MARTENS (*Prometheus, 6 (1895), No. 38, 39*).

Results of the inquiry about varieties of sugar cane, F. A. F. C. WENT and H. C. P. GEERLIGS (*West Java Sugar Sta. Bul. 21, pp. 3–20*).—A summary of information obtained from the sugar manufacturers of Java on their results in the culture of foreign varieties of sugar cane.

A contribution to the culture of hairy vetch, HEEDER (*Ztschr. landw. Ver. Rheinpreussen, 12 (1895), No. 34, pp. 274, 275*).

Experiments with a nine-year rotation, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 197–205*).—The crops grown were potatoes, lupines, rye, beets,

barley, peas and vetch, rye, mustard and serradella, and oats. Results are tabulated but not discussed.

Continuous culture of oats, barley, potatoes, rye, clover, peas, and buckwheat with and without fertilizers, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 192–197*).—The results are tabulated in detail but not discussed at length.

HORTICULTURE.

The growth of radishes as affected by the size and weight of the seed, B. T. GALLOWAY (*Agl. Sci., 8 (1895), No. 12, pp. 557–567*).—A detailed report of experiments with radishes grown under glass to ascertain the influence of seed on the yield and earliness of the vegetables. The varieties Ne Plus Ultra and Prussian Globe were employed, 100 large and 100 small seeds of each being planted. The large Ne Plus Ultra seed varied in weight from 13 to 15 mg., as against 13 to 29 mg. for the large Prussian Globe seed, while the small Ne Plus Ultra seed ranged between 2 and 7 mg., and the small Prussian Globe seed between 4 and 18 mg. Elaborate tables are given showing the weight of each seed, the weight of the resulting plant, and the ratio of the seed to the product. It was found that the large seed germinated more quickly and with more certainty and produced marketable plants sooner and more uniformly than the small seed, while the small seed gave proportionately larger plants than the large seed, though not to an extent believed to be advantageous in practice.

Total number of plants and marketable and unmarketable radishes produced from 100 seed.

Kind of seed	Number of plants	Number marketable	Number not marketable	Per cent of marketable radishes	Per cent of unmarketable radishes.
Ne Plus Ultra large seed	82	77	5	94	6
Ne Plus Ultra small seed	58	31	27	54	46
Prussian Globe large seed	90	77	13	85	15
Prussian Globe small seed	78	49	29	63	37

Food requirements of the tomato crop, J. J. WILLIS (*Gard. Chron., 18 (1895), No. 153, p. 235*).—This is a popular article on the subject, with a tabulated analysis of tomato vines, roots, and fruits, as regards the fertilizing constituents and consequent generalizations from the results of fertilizing experiments. The matter is compiled from American sources, chiefly from investigations made by the Connecticut and New Jersey Experiment Stations. It is urged that potash is by far the most important fertilizer, but that the plants should also be supplied with phosphoric acid and lime, after which nitrogen should be used freely but economically, small quantities being applied frequently. The chemical analyses are quoted from E. H. Jenkins, of the Connecticut State Station, and the fertilizer deductions from the New Jersey Station.

Sketch of the relationship between American and Eastern Asian fruits, L. H. BAILEY (*U. S. Dept. Agr. Yearbook 1894, pp. 437–442*).—This paper briefly recites some of the old theories for the numerous relationships existing between the flora of Eastern North America and Japan, and explains the botanical facts as being due to geological causes and climatic changes. The author shows that the temperate flora flourishing in the Arctic zone during the pre-glacial period was driven southward by the ice sheet, and now persists in the Alleghany region and in Japan because of suitable and similar climate. The progress and effect of the geological and climatic changes is described in brief detail. A list is given of 22 species of Europo-Asian and 21 of Eastern Asian fruits that are being grown in the United States.

Ash analysis of the orange tree (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895), No. 6, pp. 119–121*).—The chemical analysis of the ash of the orange tree in its different parts as reported by Rowney and How are given. The percentages are taken after the deduction of the unessential elements.

Ash analysis of the orange tree.

	Root	Stem.	Leaves.	Fruit.	Seed
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Potash	15.43	11.69	16.51	36.42	40.28
Soda	4.52	3.07	1.68	11.42	0.92
Lime	49.89	55.13	56.38	24.52	18.97
Magnesia	6.91	6.34	5.72	8.06	8.74
Iron sesquioxid	1.02	0.57	0.52	0.46	0.80
Sodium chlorid	1.18	0.25	6.66	3.87	0.82
Phosphoric acid	13.47	17.09	3.27	11.07	23.24
Sulphuric acid	5.78	4.64	4.43	3.74	5.10
Silicic acid	1.75	1.22	4.83	0.44	1.13
Total	100.00	100.00	100.00	100.00	100.00

Fertilization of the soil as affecting the orange in health and disease, H. J. WEBBER (*U. S. Dept. Agr. Yearbook 1891, pp. 193–202, figs. 2*).—The author gives a report upon the effect of various fertilizers upon the orange, his conclusions being as follows:

"(1) By a proper combination of the various elements used in fertilization one can undoubtedly largely govern the quality and flavor of the fruit.

"(2) To obtain a fruit with thin rind, use nitrogen from inorganic sources in moderate quantities, with considerable potash and lime.

"(3) To sweeten the fruit, use sulphate of ammonia in considerable abundance, decreasing the amount of potash.

"(4) To render the fruit more acid, increase the amount of potash and use nitrogen from organic sources.

"(5) If it is desired to increase the size of the fruit, as is sometimes the case, apply a comparatively heavy dressing of nitrogen in some organic form and slightly decrease the other elements. In the case of the tangerine and mandarin, where a larger size is usually desired, a heavy dressing of nitrogen fertilizers would favor this end, and is not objectionable unless carried to excess.

"(6) Fertilization has an important bearing on diseases.

"(7) Die-back, a serious malady, is in all probability the result of overfeeding with nitrogenous manures from organic sources. These manures, if used at all, should be applied with great caution.

"(8) Foot rot, although not primarily due to improper methods of fertilization, is no doubt considerably influenced by this cause.

"(9) Insect diseases are also apparently influenced by the use of fertilizers, organic manures rendering the trees more liable to injury from this source than chemical fertilizers."

The revolution in tree planting, H. M. STRINGFELLOW (*Texas Farm and Ranch, 11 (1895), No. 18, pp. 10, 11, fig. 1*).—The writer strongly urges that when 1 to 2 year-old trees are planted the roots be cut back to stubs about an inch long and the trunk pruned to a branchless whip from 1 to 3 ft. high. It is maintained that by this means new roots grow strong and deep, almost directly downward, thus avoiding the drought that often affects the surface roots of young trees planted in the ordinary method. Successful experiments are cited in support of this method, and especially a peach orchard of 100,000 trees planted in Georgia in this way.

It is directed that the roots be cut cleanly in a horizontal plane, a hole 2 in. in diameter dibbled in well worked soil, the tree inserted, and the earth tramped close around it. The writer suggests that the experiment stations take up the subject and experiment with different trees and lengths of roots and trunks.

Blackberries, L. H. BAILEY (*New York Cornell Sta. Bul. 99, pp. 417–438, figs. 11*).

Synopsis.—This bulletin consists of cultural notes on the blackberry, remarks on the botanical relationship of the different varieties, and illustrated descriptions of several of the leading varieties.

The neglect of blackberry culture in western New York is deplored, as the author believes that cultivated blackberries are much preferable to the wild fruit, and strongly urges an extension of the industry. A deep, mellow clay loam is advised as best blackberry land, gravelly soils being considered too deficient in water. Deep, careful plowing before setting the plants is urged to guard against the effects of drought. It is advised that the blackberries be set out in the spring, yearling plants being used, either from suckers or root cuttings. The plants may be set 2 or 3 ft. apart, in 8-foot rows, furrows 6 or 7 in. deep having first been plowed. If the land is thin, barnyard manure may be scattered in the furrows. For a year or two some hoed crop, such as strawberries or potatoes, may be grown between the rows.

The plantation will come into full bearing in about 2 years. It is recommended that 3 or 4 canes be allowed to each plant, removing the old canes as soon as the fruit is off and heading in the growing canes at the height of 2½ to 3 ft. Many of the varieties will require no support, but with some of the taller varieties training to single or 2-wire trellises will be found advantageous. It is believed that blackberries will normally be hardy in western New York, though if a severe winter is apprehended they may be bent over and covered with earth, care being taken to raise them in the spring before the buds

become soft and white. Careful tillage is urged and cultivation each week is recommended. Barnyard manure is considered one of the best fertilizing agents. With good attention on fair land a yield of 200 bu. per acre is not considered excessive, and a plantation should bear for 20 years if proper care be given it.

Frost is the most serious drawback to the blackberry crop in New York, although the red rust or yellows, root gall, anthracnose, and cane knot sometimes attack the plant. For the first two, cutting out diseased canes is believed to be the only remedy, while for the latter two spraying with Bordeaux mixture is stated to be efficient.

Five types of blackberries are recognized: The long cluster blackberries (*Rubus villosus*), comprising Taylor, Early Cluster, and Ancient Briton; short cluster blackberries (*R. villosus* var. *sativus*), comprising New Rochelle, Kittatinny, Snyder, Agawam, Erie, Minnewaski, and Mersereau; leafy cluster blackberries (*R. villosus* var. *frondosus*), comprising Early Harvest and Brunton Early; loose cluster blackberries (*R. villosus* × *R. canadensis*), comprising Wilson Early, Wilson Junior, Sterling Thornless, Rathbun, and Thompson Early Mammoth; and sand blackberries (*R. cuneifolius*), comprising the Tree Blackberry and Topsy.

Botanical descriptions are given of these 5 classes, the short clustered blackberry being the form most commonly cultivated. Illustrated descriptions are given of 11 leading varieties.

For the region of western New York the vareities Snyder, Taylor, Early Cluster, Ancient Briton, Agawam, and Minnewaski are recommended.

A summary is given embodying the main points of the bulletin.

Small fruit notes (*New York State Sta. Bul. 91, n. ser., pp. 187–207*).—*A new strawberry* (pp. 187, 188).—This is an account and description of one of the station seedlings that has been named Hunn and which is believed to be a promising late variety as regards size, quality, productiveness, and length of season.

Strawberries, raspberries, blackberries, and dewberries (pp. 189–207).—Descriptive notes are given on 50 varieties of strawberries tested at the station. Tabulated data are given for 32 varieties fruited in 1-year-old beds, Barton Eclipse, Edgar Queen, and Edward Favorite being most productive. Of early varieties Marston gave the largest yield, in addition being the most productive variety fruited for the first time. Edward Favorite was considered the best late variety. A tabulated list of 26 varieties is given, comparing their rank as regards yield in 1894 and 1895, much variation being noted.

A list of 23 varieties of blackberries and 3 of dewberries is given, showing the extent to which the canes were injured by the winter, 90 per cent of Cluster being winterkilled while only 10 per cent of Child Everbearing Tree and Snyder were destroyed.

Descriptive notes are given for 13 varieties of black raspberries, and

a list of 28 varieties included, showing the extent of winterkilling of the cane, Lotta being damaged 80 per cent while a number of others escaped uninjured. Descriptive notes are given of 7 varieties of red raspberries and tabulated data for 17 varieties, showing the relative productiveness and season. Eight late varieties are tabulated according to yield, Superb and Olathe ranking first and second. Four varieties of early red raspberries are tabulated according to yield, Pomona ranking first. Among the varieties of purple raspberries tested, Columbian and Cardinal ranked first and second. Carolina and Golden Queen gave the best yield among yellow raspberries.

Investigations as to the composition of grapes of the principal French stocks, A. GIRARD and L. LINDET (*Compt. Rend., 121* (*1895*), *No. 1, pp. 182–187*).—This is an author's abstract of a lengthy memoir of analyses and conclusions.[1] Twenty-five varieties of white and colored grapes were analyzed, 7 different regions being represented, the varieties differing in each. All portions of the bunches were subjected to precise chemical analysis, the peduncles and pedicels, skins, pulp, and seeds being each treated separately.

In the peduncles and pedicels, and the seeds as well, associated with tannin and probably formed in connection with it, was found a substance analogous to a resin, sweetening with age, and believed to play a part in the change of the taste of old wines. The seeds were also found to contain sometimes as much as 1 per cent of volatile acids, that the authors are convinced have an important role in the production of the bouquets of wines by their etherification. There was also discovered in the skins an odorous substance, differing with each stock, which scents new wines, but weakens with time, as the ether perfumes are formed. In the pulp but little tartaric acid was found, more malic acid being present.

The composition was found to vary considerably with the different varieties, and in the same variety grown in different regions. The pulp averaged in weight from 87 to 89 per cent of the whole berry, ranging between 81 and 91, and being reasonably constant, while the amounts of skin and seeds were exceedingly variable, ranging from 6 to 11 per cent for the seeds. The sugar in the pulp varied from 14 to 23.5 per cent, and averaged about 20, while the bitartrate of potassium ranged from 0.50 to 0.70 per cent. The tannin was quite variable, with extremes of 1.06 and 4.23 per cent in colored grapes, and averaging about 0.30 per cent in white grapes.

It is the intention of the authors to pursue their investigations further, and to attempt to ascertain the rôles played by the different components in the quality and flavor of wines.

Asparagus culture for city and village lots, W. W. TRACY (*Garden and Forest, 9* (*1896*), *No. 410, p. 7*).—A short article advocating the growing on a small scale.

[1] Bul. Min. Agr. France, 14 (1895), No. 6, pp. 694–782.

Farm manure and mineral fertilizers in garden culture, L. GRANDEAU (*Ann. Sci. Agron., 2 (1894–95), No. 1, pp. 25–44*).—A review of Dyer's experiments in England.

Bean growing in California, L. B. HOGUE (*Amer. Florist, 11 (1895), No. 395, p. 566*).—Notes on the culture of the Lima bean in the Carpinteria and Ventura valleys near Santa Barbara. The beans are planted in May and the crop harvested in September, and threshed by steam machines, or if intended for the seed trade, by means of driving horses over the vines while piled on a threshing floor, and afterwards winnowing and screening the beans. About 100 carloads, estimated at 10 tons each, are annually sent out from the Carpinteria Valley, and 1,200 carloads from the Ventura Valley.

Forcing beans, A. NYS (*Belg. Hort. et Agr., 7 (1895), No. 23, pp. 357, 358, fig. 1*).—A short article giving brief notes on raising winter beans under glass.

Eatable cucumbers, W. IGGULDEN (*Garden, 48 (1895), No. 1258, pp. 505, 506*).—The author believes that the indigestibility of cucumbers is largely due to their being picked too late, and urges the gathering for table use while they are still young and crisp.

A comparative fertilizer experiment on kohl-rabi and endive (*Gartenflora, 44 (1895), No. 19, pp. 522–526; abs. in Bot. Centbl., 64 (1895), No. 5, pp. 182–186*).

Vegetable marrow (*Gard. Chron., 18 (1895), No. 470, p. 764, fig. 1*).—Note and illustration of the fruit of a climbing cucurbit sent to England from the Antibes.

Edible toadstools and mushrooms and how to distinguish them, W. H. GIBSON (*New York: Harper & Bro., 1895, pp. 337, pls. 30, figs. 57*).

Poisoning by Amanita pantherina, V. HARLAY (*Bul. Soc. Mycol. France, 11 (1895), No. 4, pp. 240–243*)

Salsify, G. ALLUARD (*Rev. Hort., 67 (1895), No. 24, pp. 580, 581, fig. 1*).—Brief notes on culture and use

Notes on forcing, W. TURNER (*Amer. Gard., 16 (1895), No. 52, pp. 412, 413*).—Brief general notes on growing tomatoes, lettuce, and beans under glass.

Irrigation in New Jersey, B. D. HALSTED (*Garden and Forest, 8 (1895), No. 409, p. 518*).—A brief note on an experiment with watering beans, peppers, and celery, the yield being trebled over that from unwatered plats.

Watering greenhouse crops, T. GREINER (*Amer. Gard., 16 (1895), No. 52, p. 412, figs. 2*).—A brief illustrated article on subirrigating greenhouse benches by means of tile.

Methods of keeping vegetables through winter, G. HEUZÉ (*Jour. Agr. Prat., 59 (1895), Nos. 47, pp. 732–734, fig. 1; 48, pp. 769–773, figs. 7; 49, pp. 799–802, figs. 6*).—A popular article.

On the culture and acclimatization of varieties of ordinary garden crops, T. VON POST (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 243–246*).

Vegetable tests, L. R. TAFT, H. P. GLADDEN, and R. J. CORYELL (*Michigan Sta. Rpt. 1893, pp. 91–107*).—A reprint from Bulletin 90 of the station (E. S. R., 4, p. 827).

Handbook of Danish Pomology, H. C. BREDSTED (*Haandbog i Dansk Pomologi. Odense: 1895*).

Report of the horticulturist of the Royal Agricultural College of Sweden, 1895, E. LINDGREN (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 197–205*).

New method of selecting cider apples (*Rev. Sci., 4 (1895), No. 18, p. 571*).

Cold storage for apples, R. P. MASON (*Amer. Cultivator, 1895, Nov. 16, p. 1*).—A brief article giving the proper temperature.

Pruning young apricot trees, G. WYTHES (*Garden, 49 (1896), No. 1259, p. 7*).—Brief notes advising but little use of the knife.

The Morello cherry as a bush tree, A. W. (*Garden, 48 (1895), No. 1256, p. 453*).—A short article advocating the dwarfing of Morellos on Mahaleb stocks, vigorously bearing trees being thus produced, which can be easily netted and the fruit so protected from birds.

A new Japanese winter cherry (*Garden, 48 (1895), No. 1255, p. 435, figs. 2*).—A short illustrated account of the ground cherry *Physalis franchetti.*

Manual of olive culture and of olive-oil manufacture, F. BRACCI (*Manuale di Olivicoltura ed Oleificio. Milan: F. Vallardi, 1894, pp. 200*).

Grafting olive trees, A. J. PERKINS (*Garden and Field, 21 (1895), No. 6, p. 154, fig. 3*).—A description of a method of side grafting by means of which the stock is not cut down until the success of the graft is assured.

The papaw (Asimina triloba), L. C. CORBETT (*Garden and Forest, 8 (1895), No. 407, p. 194, fig. 1*).—A brief descriptive article, with illustration of the fruit, urging the more extensive growing of the papaw both for fruit and ornament.

Fruit notes, L. R. TAFT (*Michigan Sta. Rpt. 1893, pp. 129–145*).—A reprint of Bulletin 92 of the station (E. S. R., 4, p. 917).

Wintering fruit and potatoes (*Amer. Hort., 5 (1895), No. 12, p. 183*).—Brief hints on storing these products, it being recommended that apples be kept in barrels in dry, cool cellars, potatoes stored in board-lined caves, and sweet potatoes in piles covered with straw, boards, and earth.

Cold storage for fruit, F. HOLSINGER (*Amer. Hort., 5 (1895), No. 12, p. 180*).—Advises the placing of fruit, especially apples, as soon as barreled, in cold storage at about 33° to keep them safely until spring.

A new fruit dryer (*Agl. Gaz. N. S. Wales, 6 (1895), No. 10, pp. 727, 728, figs. 2*).

Grafting oranges, evergreens, and herbaceous plants, W. REDDAN (*Garden and Field, 21 (1895), No. 6, pp. 154, 155, fig. 1*).—Illustrated description of a method in which the scion is split, half being grafted into the stock and the end of the other half kept in a bottle of water or moist sand until the union is assured.

Budding or bud grafting, W. C. G. (*Garden and Field, 21 (1895), No. 6, pp. 153, 154, figs. 7*).—An article giving directions for different styles of budding, and illustrated in most part from photographs.

Fruit-tree roots (*Gard. Chron., 18 (1895), No. 467, p. 557, figs. 3*).—Urges the careful, clean trimming of roots when transplanting trees, and illustrates proper and improper methods.

Manuring fruit trees, L. GRANDEAU (*Jour. Agr. Prat., 59 (1895), Nos. 47, pp. 721–723; 49, pp. 793–795*).—A popular article.

Setting out fruit trees for irrigation, F. C. BARKER (*Irrigation Age, 8 (1895), No. 8, p. 238*).—General directions.

Improvement in fruits, C. WRIGHT (*Amer. Gard., 17 (1896), No. 54, p. 4*).—Brief remarks on the superiority of recent varieties of fruits as compared to those common in earlier years.

Eighty new strawberries, L. R. TAFT (*Michigan Sta. Rpt. 1893, pp. 416–428*).—A reprint of Bulletin 100 of the station (E. S. R., 5, p. 681).

To avoid drought in the culture of small fruit, H. R. COTTA (*Amer. Agr. (middle ed.), 1895, Dec. 21, p. 575, fig. 1*).—Methods of culture are described and the root system of gooseberries is figured.

The better forms to give vines on espaliers, N. SCHNEIDER (*Rev. Hort., 67 (1895), No. 24, pp. 581, 582*).—Brief directions for training grapevines in horizontal and vertical biennial cordons.

Grapes under glass, W. SCOTT (*Garden and Forest, 8 (1895), No. 407, pp. 196, 497*).—A brief note on the best varieties, Black Hamburg and White Muscat of Alexandria being especially recommended.

American grapevines in calcareous soils, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 46, pp. 522–526*).

American vines in the siliceous clay soils of the southeast of France, L. DE MALAFOSSE (*Prog. Agr. et Vit., 12 (1895), No. 46, pp. 514–516*).

Through American eyes (*Amer. Florist, 11 (1895), No. 395, pp. 554–556, figs. 2*).—A short article describing the growing of grapes under glass in England, and illustrated from photographs.

Researches on the vineyards of Champagne, A. MÜNTZ and E. ROUSSEAUX (*Bul. Min. Agr. France, 14 (1895), No. 5, pp. 504–543*).—A study of the amounts of fertilizing materials removed in wine, lees, marc, twigs, and leaves, and of fertilizers

applied to vines in localities in France. A brief account of cultural operations for each month is given.

An improved vine cutter (*Sci. Amer., 1895, Nov. 16, p. 308, fig. 1*).

Walnut cultivation in France (*Jour. Hort., 1895, No. 2465, p. 598*).—A brief note on this industry, which appears to be prospering.

The carnation, F. DORNER (*Amer. Florist, 11 (1895), No. 394, pp. 529–532*).—An address before the Cincinnati Florists' Society, speaking of the general principles of the culture of the flower, selected stock and careful cultivation being urged and several leading varieties briefly noted.

How to grow carnations profitably, F. W. UDE, Jr. (*Amer. Florist, 11 (1895), No. 394, p. 532*).—A short abstract of a paper read before the St. Louis Florists' Club, giving detailed directions for the proper culture.

Résumé of the work of the Chrysanthemum Society of America for 1895 (*Amer. Florist, 11 (1895), No. 393, pp. 501, 505*).—A list, with tabulated data, of a number of varieties of chrysanthemums introduced in 1895.

Analysis of the ash of Chrysanthemum segetum, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 227, 228*).

Pruning late-planted roses, J. C. CLARKE (*Garden, 48 (1895), No. 1257, p. 471*).—A brief note, the author advising that the plants be pruned before planting.

Colors in flowers (*Garden, 48 (1895), No. 1257, p. 487*).—Brief mention of genera of plants producing both blue and yellow flowers.

Alteration in the colors of flowers by cyanid fumes, T. D. A. COCKERELL (*Nature, 52 (1895), No. 1352, p. 520*).—A brief note on some experiments in which pink, purple, and white flowers changed to a yellow color and red flowers to a light pink.

Fancy bedding (*Amer. Florist, 11 (1896), No. 396, p. 780*).—Reprints from the *New York Independent* and *Garden and Forest* for and against elaborate floral designs in public parks.

Flowers for food, P. L. SIMMONDS (*Gard. Chron., 18 (1895), No. 470, pp. 762, 763*).—A short article on various flowers that are made use of as edibles, among others being mentioned banana blossoms in India and China; the sweet flowers of several species of Bassia, eaten eagerly by the poorer classes in India; violets used by the Romans for wine and in Turkey for sherbet, and elsewhere for candying; quassia flowers; various lilies; cloves; crocus stigmas (saffron); capers; nasturtiums; and marigolds.

Pruning of street trees, G. W. OLIVER (*Garden and Forest, 8 (1895), No. 409, pp. 514–516*).—A short article showing that in Washington, D. C., experience teaches that much better growth and more shapely crowns can be had by vigorous pruning of the younger trees.

Schools of horticulture (*Garden and Forest, 8 (1895), No. 405, pp. 471, 472*).

Horticulture at Cornell. L. H. BAILEY (*Science, n. ser., 2 (1895), No. 51, pp. 831–839*).—A brief outline of the purposes and methods of work in horticulture as pursued at Cornell University, detailing the courses of lectures and laboratory work at the university and the lectures presented to the farmers of the State. The following topics are treated: Material equipment, the motive of instruction, horticulture as a science, the courses of instruction, extension teaching, experiment or research work, and unsupplied demands.

The garden of the Steigen parsonage (*Norsk Havetidende, 11 (1895), pp. 137–143*).—A catalogue and description of the trees and shrubs planted and growing in the garden of the Steigen parsonage in northern Norway (latitude 67° 56′). The average temperature for February, the coldest month in the year, is 25.5° F.; for August, the warmest month, 51.6°; the average temperature for the year is 38.5° F.

FORESTRY.

Forestry, L. C. CORBETT (*South Dakota Sta. Bul. 44, pp. 127-151*).—This bulletin reports conclusions derived from the study of various forest trees planted in 10 plats in different combinations of species, 20 species of deciduous and evergreen trees being used in the investigation. Brief remarks are made on the hardiness and adaptability of trees in general, a careful study of the peculiarities of the species being urged before planting them in any given locality. A table is given showing the meteorological record from 1889 to 1894, inclusive, and a table comparing the growths of the several species for that length of time. A comparison of tree growth and precipitation is shown on a chart for 11 species, which appear to arrange themselves into wet weather, dry weather, and independent groups.

The Scotch pine, green ash, and cottonwood follow closely in their growth deviations in the moisture curve, while the box elder, white elm, bur oak, and black walnut seem to thrive best with little rainfall, and the silver maple, white birch, European larch, and black cherry appear to be independent of the moisture conditions.

Tables are given for the 10 plats, showing the number of trees planted in 1891 and the number standing in 1895, with the height and circumference of the tallest trees and average growth.

The wild black cherry, white birch, white elm, Scotch pine, red cedar, and cottonwood were found to be little if any injured by late spring frosts, the European larch, walnut, oak, and ash on the contrary suffering severely. The age of a tree and conditions under which it grew were found to have as much influence on the injury from late frost as did the species to which it belonged. It was found advisable to prune the trees artificially in preference to trusting to natural pruning. Pure plantations of one species were advised except in the case of maple from seed. *Populus laurifolia*, cottonwood, European larch, and *Salix fragilis* were discarded as of uncertain value for groves and upon high prairies. For general planting are recommended white elm, green ash, wild black cherry, bur oak, black walnut, white birch, box elder, laurel-leaved willow, Scotch pine, red cedar, and white spruce, with cottonwood for streets or lowland groves and balm of gilead as specimen trees.

Native shrubs and trees of South Dakota, T. A. WILLIAMS (*South Dakota Sta. Bul. 43, pp. 95-123*).—The author gives a report of 117 species of woody plants, classified as follows: Trees 37, shrubs 74, and woody climbers 6. Notes are given on the distribution of the different species throughout the State, and the arboreal and arborescent floras of 5 of the more conspicuous regions of the State are listed as follows: Common throughout the State 25 species, Big Stone region 46, Sioux Valley region 37, James Valley region 72, Missouri Valley region 72, and Black Hills region 82.

Artificial forest growth in Kansas, J. B. THOBURN (*Kansas State Bd. Agr. Rpt. 1895, Mar. 31, pp. 138-141*).—Brief remarks on efforts to grow forest trees in Kansas with varying success. Catalpas, white ash, and walnut appear to thrive, and it is urged that pines and cedars be tested in this respect. The conditions for successful forest growing are enumerated as shade, mixed planting, and the planting of trees known to thrive in that section.

Forestry for farmers, B. E. FERNOW (*U. S. Dept. Agr. Yearbook 1894, pp. 461-500, figs. 15*).—The author has given a popular account of the way in which trees grow, their requirements of light, soil, moisture, etc., together with all the more conspicuous phenomena of growth. Directions are given upon what trees to plant and how to plant them, as well as their subsequent management.

American Forestry Association, F. H. NEWELL (*Science, n. ser., 2 (1895), No. 39, pp. 385-390*).—A brief report is given by the secretary of the meeting held at Springfield, Massachusetts, September 4 and 5, 1895.

The practical value of forests to the surface of the country, F. H. HAHN (*Forest Leaves, 5 (1895), No. 5, pp. 74-77*).

The planting of woodland areas, C. E. CURTIS (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 22, pp. 276-288*).

The locust tree, J. T. ROTHROCK (*Forest Leaves, 5 (1895), No. 5, pp. 72, 73, pls. 2*).—Illustrated descriptive notes on *Robinia pseudacacia*.

Influence of climate on the growth of fir trees, E. MER (*Jour. Bot. France, 9 (1895), Nos. 10, pp. 178-180; 11, pp. 202-206; 12, pp. 222-228; 13, pp. 229-233; 14, pp. 247-255*).

The harvesting of pine and fir seeds, A. FJRAGEN (*Tidsskr. norske Landbr., 2 (1895), pp. 7-16*).

The injury of pines by Cenangium abietis, F. SCHWARZ (*Abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 20-21, pp. 768, 769*).

Notes on some arborescent willows of North America, II, M. S. BEBB (*Garden and Forest, 8 (1895), No. 395, pp. 372, 373*).—Notes are given on *Salix taxifolia, S. lasiandra caudata, S. flavescens capreoides*, and *S. missouriensis*. The latter is described as a new species.

Notes on some arborescent willows of North America, III, M. S. BEBB (*Garden and Forest, 8 (1895), No. 400, p. 423, figs. 2*).

Willows along banks of rivers, J. T. ROTHROCK (*Forest Leaves, 5 (1895), No. 5, pp. 66, 67*).—Notes on the value of willow to prevent the encroachments of streams on adjoining fields.

Trees for orchard wind-breaks, F. A. WAUGH (*Amer. Hort., 5 (1895), No. 11, pp. 161, 162*).—A short article on the subject advising the practice on the prairies and recommending osage-orange hedges, and belts of honey locust, alternated with Russian mulberries. Red cedars are also favored, but precise choice depends on soil, situation, and circumstances.

The woods of the alluvial region of the Mississippi River in the States of Louisiana, Mississippi, and Arkansas, C. MOHR (*Pharm. Rundschau, 13 (1895), pp. 14 and 30; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 4, pp. 286, 287*).—Notes are given on forest flora of this region.

Ohio forest trees, W. A. KELLERMAN (*Columbus: 1895, pp. 16*).

On Pennsylvania forests, J. T. ROTHROCK (*Jour. Franklin Inst., 140 (1895), No. 836, pp. 100-117*).—An address on forests and their management, delivered January 4, 1895, before the Franklin Institute.

Our Pennsylvania forests, J. HAMILTON (*Pennsylvania Bd. Agr. Rpt. 1894, pp. 348-358*).

SEEDS—WEEDS.

Experiments with tree seed, W. SOMERVILLE (*Bd. Agr. Rpt. Distrib. Grants for Agl. Education in Great Britain, 1891–'95, pp. 62–65*).—Experiments were conducted with various kinds of tree seed to ascertain among other things the most suitable depth to plant, effect of drilling or broadcoast sowing, and of thick or thin sowing. Experiments conducted with Norway spruce showed that the best results followed covering the seed to a depth of only ¼ in., while for acorns 2 in. gave the highest average germinations. Walnuts gave but little difference in germination when covered to depths of 2, 4, and 6 in., the latter being slightly the most profitable. Norway spruce seed sown in drills and broadcast gave results greatly in favor of drilling. In the case of thick and thin seeding of the same kind of seed, it was found that ¾ oz. gave more favorable results than when 1½ oz. was used. The size of the plats was 15 square feet.

Experiments were conducted with ash seed to hasten its germination. Seed was sown in autumn, kept in sand during the winter, and treated with water at 180° F. for 3 minutes before planting, but in every case the seed grown in 1893 failed to germinate until the spring of 1895. It is said that seed of the hawthorn, apple, cembrian pine, *Medicago lupulina*, and *Plantago major* behave in a similar way; that is, lie dormant in the soil for a year before sprouting.

On the presence of hard seed among clover seed, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 97–102*).—As imbibition and swelling are preludes to germination, the author has investigated the subject of hard or impervious seed in the various clovers, such seed being practically without value in agriculture. As a rule the greater per cent of hard seed is to be found among the small seed. This was found especially true of red and white clover.

Per cent of hard seed in various clovers.

Kind of seed	No of tests.	Maximum.	Minimum	Average.
		Per cent	*Per cent*	*Per cent.*
White clover	1 697	60	0	12 6
Red clover	2,633	65	0	8 3
Lucern	71	32	1	11.0
Yellow clover	864	63	0	9.6
Alsike	571	52	0	7.9
Kidney vetch	145	22	0	7 8

On the germination of various colored clover seed, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 96, 97*).—The author gives the results of a series of investigations on the germination of different colored clover seed. He found the following averages: Bright-yellow seed, 89 per cent; variegated seed, 88 per cent; clear dark-green seed, 90 per cent. It is stated that the color of the fresh seed may be used as a measure of their vitality.

The relation of weight to the vitality of the seed of rye grasses, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 102–111*).—The author has made a study of English and Italian rye grasses, *Lolium perenne* and *L. italicum*, to determine the relation between weight and vitality of their seed. The experiments extended over 14 years, and the results show that the per cent of seed capable of germination increases with the weight of the individual seed.

Results of seed investigations, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 111–140*).—A report is given on the various kinds of seed tested at the station from its foundation in 1875 until 1892. The following are reported upon: Nine varieties of legumes, 13 of grass seed, and 10 of miscellaneous cultivated plants.

Seventeenth technical report of the Federal Seed-Control Station at Zurich, F. G. STEBLER and E. THIELÉ (*pp. 12*).—During the year 6,049 lots of seed from 484 persons were received at the station for testing, this number being an increase of 91 lots of seed and of 2 in the number of individuals to avail themselves of the privileges of the station. In testing these seed 16,289 separate experiments were required, as follows: Purity 4,273, germinative ability 5,188, inspection for dodder and pimpernel 2,079, and qualitative tests 4,749. According to the guaranty contract system of the station 1,916 lots of seed were reëxamined and 8.7 per cent as compared with 11.2 per cent of the previous year were found to fall below the guaranteed value. The kinds of seed tested were as follows: 14 varieties of clover, 39 of grass, 3 of perennial forage plants, 10 of annual forage plants, 7 of legumes not forage plants, 5 of grains, 2 of fiber plants, 11 of root crops, 30 of tree seeds, and 2 others, the clover, grass, and tree seed representing 92.7 per cent of all seed examined.

Tabular information is given of the results of 19 years of seed testing in which is shown the number of lots of each kind of seed tested and its average purity, germinative ability, and intrinsic worth are stated. Under the guaranty system of the station more than 375,000 kg. of seed were certified to during the year.

Effect of size of seed upon their productivity, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 141–154*).—Increased production followed the use of larger seed for seeding.

Concerning the treatment of hard seed, F. NOBBE (*Mitt. deut. landw. Ges., 1895, No. 21, p. 211*).—A description is given of a machine for treating hard seed coats so as to secure a better germination of the seed.

On the treatment of hard clover seed, J. V. P. WISSINGER (*Landw. Centbl. Posen, 1895, No. 50, pp. 297, 298*).—Directions are given for treating seed which, on account of hard seed coats, are deficient in germinative power.

The influence of oil on the germination of seed containing it (*Tirol. landw. Blätter, 14 (1895), No. 22, p. 197*).

Observations upon the dissemination of seed, M. F. BOYNTON (*Bot. Gaz., 20 (1895), No. 11, pp. 502, 503*).—The author gives observations on the distance to which seed of *Hamamelis virginica*, *Œnothera biennis*, and *Datura stramonium* are ejected.

Pure seed investigation, G. H. HICKS (*U. S. Dept. Agr. Yearbook 1894, pp. 389–408, figs. 9*).—The author calls attention to the necessity of seed control to prevent

many abuses now prevailing in the trade. A brief historical statement is given of seed control in Europe, together with detailed accounts of the methods of control, germinating tests, and equipment required for seed investigation.

Concerning the growth of Orobanche spp., B. JÖNSSON (*Acta Reg. Soc. Physiogr. Lund, 6 (1895), pp. 23, pls. 2; abs. in Bot. Centbl., 61 (1895), No. 12, p. 420*).

Distribution of the Russian thistle in North America, L. H. DEWEY (*Bot. Gaz., 20 (1895), No. 11, p. 501, map 1*).

Sisymbrium altissimum in Minnesota, E. P. SHELDON (*Torrey Bul., 22 (1895), No. 11, pp. 471, 472*).—Notes are given of the occurrence and distribution of this weed throughout the State.

Some western weeds and alien weeds in the West, T. D. A. COCKERELL (*Bot. Gaz., 20 (1895), No. 11, pp. 503, 504*).—Notes are given of *Solanum* spp., *Sonchus oleraceus, Senecio vulgaris, Plantago major*, and *Erodium cicutarium*.

The weeds of New South Wales, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 6 (1895), No. 10, pp. 671-678*).—Notes are given of numerous weeds arranged under their natural orders.

Stinkwort, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 6 (1895), No. 10, pp. 667-670, pl. 1*).—Notes are given upon *Inula graveolens*, a threatening weed in New South Wales.

On the eradication of colchicum (*Ind. Lait. 20 (1895), No. 17, p. 307*).

On the destruction of Cuscuta, L. DEGRULLY (*Prog. Agr. et Vit., 12 (1895), No. 51, p. 655*).—Methods are suggested for the eradication of the various species of this plant.

Weeds of Swedish moorlands, R. TOLF (*Svenska Mossk. Foren. Tidskr., 1895, pp. 135-148, 245-256*).

DISEASES OF PLANTS.

The spot disease of orchids, G. MASSEE (*Ann. Bot., 9 (1895), No. 35, pp. 421-429, pl. 1*).—This disease was first described by the author[1] as due to *Plasmodiophora orchidis*, but subsequent investigations demonstrated that it was not of parasitic origin, but was caused by physiological conditions. It was found that the initial cause of the disease is the presence of minute drops of water on the surface of the leaves at a time when the temperature is exceptionally low and the roots well supplied with water. The effect of the chill is to cause plasmolysis of the cells of the leaf underlying the drops. This is followed by a precipitation of tannin and other substances, and eventually by the complete disintegration of the cells. Experiments were conducted by placing small particles of ice upon leaves and keeping the plant at an abnormally low temperature. A fall of 30° could not produce the spot unless the leaf were moist and it was found that water at a temperature of 45° could take the place of the ice. It was found that a fall in the temperature of less than 9° would not produce the disease even if the other conditions were favorable. The spot disease can be produced with the greatest certainty and in the shortest time when the experiment is conducted in an atmosphere saturated with moisture.

The author states that brunissure or browning of grape leaves, as described by Viala and Savageau as due to *Plasmodiophora vitis*[2], can be produced when there is a copious deposition of dew and a rapid fall

[1] Ann. Bot., 9 (1895), p. 170 (E. S. R., 6, p. 910).
[2] Compt. Rend., 115 (1892), No. 1, p. 67 (E. S. R., 4, p. 381).

of temperature following a heavy rain. Similar conditions produce the disease in tomato leaves which has been described by Abbey[1] as due to *P. tomati.*

In the case of the orchid spot disease the author concludes it is caused by the following conditions: (1) Too high a temperature, (2) too much water and not enough air to the roots, and (3) watering or spraying with a falling instead of a rising temperature.

A text-book of the diseases of trees, R. HARTIG (*Translated by W. Sommerville, revised and edited by H. Marshall Ward. London and New York: Macmillan & Co., 1894, pp. XVI+330; figs. 159*).—This admirable work, which is largely compiled from previous publications of the author, discusses the diseases according to the external influences inducing them as follows: Diseases due to (1) phanerogams, (2) cryptogams, (3) wounds, (4) unfavorable conditions of the soil, and (5) unfavorable atmospheric conditions. The author distinguishes between sickliness, which may be due to lack of the proper physiological conditions, such not being considered the province of pathology, and the more vital phenomena, which bring about the premature death of the plant or some portion of it. While called a text-book of the diseases of trees, incidentally the principal diseases of many other plants are mentioned at some length. Naturally, the diseases due to fungi occupy the greater portion of the work, at least 75 being described at considerable length and many more mentioned or referred to very briefly. A chapter is given on the destruction of structural timber by fungi that is suggestive of means for the prevention of such loss. Wherever possible suggestions are given as to preventive measures to be adopted for the repression of the various diseases.

The editor has confined himself to mentioning the occurrence of the principal diseases in his country and to the addition of a few references, all of which are given as foot notes. The book, which may be considered as a rather popular one, has required an occasional interpolation to explain terms that would not be understood by those who are not professionally engaged in this branch of science.

The concluding chapter of the book gives briefly a description of the diseases mentioned in the work, classified according to the plant and the part of the plant affected and the cause of the disease. Such a table as this will enable one to readily diagnose any of the more conspicuous diseases.

The publishers have not left anything to be desired in the way of illustrations and typography, the book being very attractive in these respects.

Concerning the reappearance of fungi after the dry period of 1895, A. HARLAY and V. HARLAY (*Bul. Soc. Mycol. France, 11 (1895), No. 4, pp. 244–246*).

Concerning the coloring of rusted flax, A. HERZOG (*Flachs und Leinen, 2 (1895), No. 20, pp. 319, 320*).

Culture experiments with heteroecious rust fungi, H. KLEBAHN (*Ztschr. Pflanzenkrank., 5 (1895), No. 5, pp. 257–268, fig. 1*).—Experiments were conducted with *Coleosporium melampyri, Æcidium seratulæ, Puccinia uliginosa, P. digraphidis, P. caricis,* and *P. pringsheimiana.*

Grain smuts, their cause and prevention, W. T. SWINGLE (*U. S. Dept. Agr. Yearbook 1894, pp. 409–420, figs. 8*).—A popular account is given as to the cause of grain smuts, and the stinking smut of wheat, loose smut of wheat, loose smut of oats, and the smuts of barley, rye, and corn, are briefly described. Various methods of treatment are fully described, the hot-water method being recommended as best for all kinds of smut.

Comparative investigations on species of smut, P. HERZBERG (*Zopf's Beitr. Morph. und Phys. niederer Organismen, 1895; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 22–23, pp. 827–830*).

The mineral constituents of ergotized rye and of sound rye, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 224–227*).

[1] Jour. Hort., ser. 3, 30 (1895), p. 360.

The cause of gumming in sugar cane, N. A. COBB (*Agl. Gaz. N. S. Wales, 6 (1895), No. 10, pp. 683–689, figs. 2*).—Notes are given upon successful inoculations with cultures of *Bacillus vascularum* in causing this disease.

Club-root experiments, J. R. CAMPBELL (*Bd. Agr. Rpt. Distrib. Grants for Agl. Education in Great Britain, 1894–'95, pp. 104–107*).—The experiments demonstrated the natural infection through the soil, and that lime when properly applied exerts a very pronounced effect upon the repression of club root.

Leaf curl of peach trees (*Meehan's Monthly, 6 (1896), No. 1, p. 14*).—Brief notes are given of the leaf curl due to *Exoascus deformans.*

Concerning bacterial gummosis of the grape, K. SCHILBERSZKY (*Abs. in Ztschr. Pflanzenkrank., 5 (1895), No. 5, pp. 305, 306*).

Notes on chlorosis, P. COSTE-FLORET (*Prog. Agr. et Vit., 12 (1895), No. 46, pp. 517–522*).

On injuries to hothouse plants by Protococcus caldariorum, L. MONTEMARTINI (*Ztschr. Pflanzenkrank., 5 (1895), No. 5, pp. 277, 278*).

Begonia disease (*Kew Misc. Bul., 1895, No. 107, pp. 285, 286*).—A disease is described due to a species of Tarsonymus. Fumes of tobacco are recommended as preventive treatment.

Studies of floral galls, M. MOLLIARD (*Ann. Sci. Nat. Bot., ser. 8, 1 (1895), Nos 1, pp. 67–80; 2–4, pp. 81–245, pls. 12*).—The author has made a study of the malformations caused in floral organs by fungi and insects.

A leaf disease of the larch, R. HARTIG (*Forstl. naturw. Ztschr., 4 (1895), No. 12, pp. 445–457, figs. 7*).—A description is given of a new fungus to which the name *Sphærella laricina* is given.

On the infection of conifers by Cenangium abietis, F. SCHWARZ (*Beitrag. Geschichte einer Pilzepidemie. Jena: G. Fischer, 1895, pp. 126, pls. 2; abs. in Bot. Centbl., 64 (1895), No. 5, pp. 180, 181*).

On a disease of Prunus spinosa contracted by maple trees, P. VUILLEMIN (*Compt. Rend., 121 (1895), No. 21, pp. 734–737*).—Notes are given of the occurrence of a species of Uncinula, probably *U. prunastri,* on the leaves of maple trees.

Two injurious parasites of Codiæum, A. ALLESCHER (*Ztschr. Pflanzenkrank., 5 (1895), No. 5, pp. 276, 277*).—Two new species, *Glæosporium sorauerianum* and *Asteroma codiæi,* are described.

Further notes on the parasitism of Nectria cinnabarina, C. WEHMER (*Ztschr. Pflanzenkrank., 5 (1895), No. 5, pp. 268–276, pl. 1*).

A remarkable Puccinia, H. T. SOPPITT (*Gard. Chron., ser. 3, 18 (1895), No. 470, p. 773*).—Notes are given of *P. bistortæ.*

Concerning the mycelium and parasitism of a new species of Sclerospora, MAGNUS (*Bot. Centbl., 64 (1895), No. 4, p. 111*).—Brief notes are given of *Sclerospora kriegeriana,* parasitic upon *Phalaris arundinacea.*

Concerning Setchellia, a genus of Ustilaginæ, P. MAGNUS (*Ber. deut. bot. Ges., 13 (1895), No. 9, pp. 468–472, pl. 1*).—The author has described *S. punctiformis* based on *Doassansia punctiformis* found upon *Butomus umbellatus.*

Some new fungi, P. DIETEL (*Hedwigia, 34 (1895), No. 6, pp. 291, 292*).—The author describes several species of fungi, of which *Ravenelia opaca* on *Gleditschia triacanthos, Puccinia oxalidis* on *Oxalis* sp., *P. amphigena* on *Calamagrostis canadensis* and *C. longifolia,* and *Synchytrium rugulosum* on an undetermined species of Onograceæ are American.

New species of fungi, C. H. PECK (*Torrey Bul., 22 (1895), No. 12, pp. 485–493*).—The author describes 23 new species of fungi, most of which are not of economic importance.

Plant diseases during 1894 in the Netherlands, J. RITZEMA-BOS (*Ztschr. Pflanzenkrank., 5 (1895), No. 5, pp. 286–290*).—A brief report is given of 340 diseases of various sorts occurring during the year.

Diseases of the vine in Portugal during 1894, V. DALMEIDA and J. PREGO (*Ann. Sci. Agron., ser. 2, 2 (1894–'95), No. 1, pp. 140–153*).

ENTOMOLOGY.

The San José scale, P. H. ROLFS (*Florida Sta. Bul. 29, pp. 90–111, figs. 1*).—This bulletin consists of illustrated, descriptive, life history, and remedial notes on *Aspidiotus perniciosus*, chiefly compiled and published in consequence of the discovery of the pest in orchards of the region about De Funiak Springs. Out of some 1,200 acres of orchards inspected, 160 to 200 acres were found to be infested, the presence of the insect being first noticed 6 years before, since which time the first orchard attacked has been practically destroyed by it. The fruits that appear to be most severely attacked are Japanese plums, followed by peaches, apples, and pears.

Kerosene emulsion and resin wash were used with good effects. The winter resin wash particularly was found to kill the scale insects, although a majority of the fruit buds were also killed. The formulas and directions for making and applying different washes are given, the spraying to be done during the dry season. Especial care is urged with reference to the examination of nursery stock for the pest, fumigating with hydrocyanic acid gas being advised. It is insisted that all badly infested trees be burned at once.

The Hessian fly, J. B. SMITH (*New Jersey Stas. Bul. 110, pp. 8, figs. 2*).—This is an illustrated descriptive paper, chiefly compiled, giving briefly the life history, injury, and treatment of *Cecidomyia destructor*. Burning the stubble, planting of early trap strips, to be destroyed when the crop wheat is sown late, and the use of good fertilizers and resistant varieties are recommended. The hymenopter *Merisus destructor* is figured as a parasite.

The Hessian fly, C. L. MARLATT (*U. S. Dept. Agr., Division of Entomology Circ. 12, pp. 4*).—A condensed popular account of the economic importance, distribution, natural history and habits, damage, natural enemies, and treatment of *Cecidomyia destructor*. The remedial methods deemed most satisfactory are late planting of winter wheat, burning stubble, rotation of crops, planting of trap wheat, and growth of resistant varieties.

Some scale insects of the orchard, L. O. HOWARD (*U. S. Dept. Agr. Yearbook 1894, pp. 249–276, figs. 17*).—This paper is a semipopular account of the more important scale insects affecting the deciduous orchards in the eastern United States, prefaced by a history of the greatly increasing invasions of scale insects, with remarks on the classification, life history, habits, and natural enemies of scale insects in general. Illustrated, descriptive, and historical notes are given on the life history, habits, distribution, food plants, and ravages of the scurfy bark louse (*Chionaspis furfurus*), oyster-shell bark louse (*Mytilaspis pomorum*), San José scale (*Aspidiotus perniciosus*), walnut scale (*A. juglans-regiæ*), greedy scale (*A. camelliæ*), West India peach scale (*Diaspis lanatus*), peach lecanium (*Lecanium persicæ*), and plum lecanium (*L.*

prunastri). An analytical key is given for the identification of the species considered, and a list of the hymenopterous parasites infesting each species.

The history of remedies against scale insects is briefly summed up. Winter washes are considered the most desirable in the majority of cases. Against the San José scale, the West Indian peach scale, the greedy scale, and the walnut scale is recommended an application of fish-oil or whale-oil soap, 2 lbs. to a gallon of water, soon after the leaves fall in the autumn. Against the oyster-shell bark louse, the scurfy louse, and the peach lecanium are recommended one or two applications of kerosene soap emulsion diluted 10 parts, between the 1st and last of June, to kill the young lice. Resin washes and fumigation are considered as of little avail in the East. The value of methods of prevention by means of insecticides and quarantine laws is strongly urged.

The more important insects injurious to stored grain, F. H. CHITTENDEN (*U. S. Dept. Agr. Yearbook 1894, pp. 277–294, figs. 9*).—This consists of illustrated descriptive notes on the life history, habits, and ravages of the more important grain insects, prefaced by brief remarks on their origin and introduction into the United States and the extent of the annual damage, with a short note on parasites and natural enemies. The following species are treated: Granary weevil (*Calandra granaria*), rice weevil (*C. oryzæ*), Angoumois grain moth (*Gelechia cerealella*), Mediterranean flour moth (*Ephestia kuehniella*), Indian-meal moth (*Plodia interpunctella*), meal snout moth (*Pyralis farinalis*), wolf moth (*Tinea granella*), saw toothed grain beetle (*Silvanus surinamensis*), slender-horned flour beetle (*Echocerus maxillosus*), confused flour beetle (*Tribolium confusum*), rust-red flour beetle (*T. ferrugineum*), square-necked grain beetle (*Cathartus gemellatus*), and cadelle (*Tenebroides mauritanicus*).

Various methods for the control of insects in stored grain are mentioned. As a preventive, placing grain in clean, tight granaries free from infested grain is recommended, with gauze at the windows to prevent the entrance of insects. In the case of stored grain being attacked, the treatment with bisulphid of carbon is urged as the simplest and most effective and inexpensive remedy, the chemical to be applied in tight bins at the rate of 1 to 1½ lbs. to a ton of grain, the granary to be closed for 24 to 36 hours, and the treatment to be repeated every 6 weeks if necessary. The cost of treatment is stated at 10 cts. for every 100 bu. of grain.

Raupenleim and dendrolene, J. B. SMITH (*New Jersey Stas. Bul. 111, pp. 11*).—This bulletin records experiments to test the actual and comparative usefulness of these two insecticidal mixtures, both of which are crude petroleum products with a base apparently of impure vaseline mixed with some substance resembling coal tar in color and odor. Raupenleim is of European manufacture, while dendrolene is of Amer-

ican origin. Both are recommended by the makers for coating the trunks of fruit trees to repel borers and prevent the attack by caterpillars of wingless moths which are obliged to ascend the trunks in order to lay their eggs among the foliage. The substances are viscid and sticky, being readily applied to trees by paddles or trowels, and yet are not soft enough to run at ordinary summer temperatures.

The insecticides were applied to pear trees with no injurious effect upon the trees. It was found that a thin application would last 6 weeks, while a coating $\frac{1}{4}$ in. thick applied 5 months before, at the date of writing was still in good condition. The raupenleim after a few weeks hardened at the surface, while the dendrolene remained soft, but lost some of the "sticky" character and resembled a grease.

The insecticides were used with good effect against the sinuate pear borer, either entirely preventing the emerging of the adults or coating them so that they soon died. The raupenleim, on account of the hardening of the outer surface, is believed to be somewhat more efficient in preventing the emergence of borers, while the dendrolene when applied to peach trees had the effect of killing borers in the trunk.

Against cankerworms and the vaporer moth (*Orgyia leucostigma*) dendrolene is believed to be preferable to raupenleim, as it does not become so stiff. It is recommended that applications be made by means of a paddle or trowel, the substance then to be distributed by means of a stiff brush. Thoroughness of application is insisted upon, and the materials are believed to be very useful for the purposes claimed. The dendrolene is somewhat the cheaper of the two.

Revision of the Aphelininæ of North America, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 1, tech. ser., pp. 44, figs. 14*).—This paper consists of illustrated technical descriptions and keys to the genera and species of these parasitic Hymenoptera found in North America. Thirteen genera and 30 species are described, Perissopterus and Physcus being described as new genera, and *Eretmocerus californicus*, *Perissopterus mexicanus*, *Aphelinus flaviceps*, *Encarsia luteola*, *E. coquilletti*, *E. angelica*, *Coccophagus scutatus*, and *C. ochraceus* as new species. Two lists of parasites and hosts are given, one showing the insects attacked by each parasite and the other giving the different species of Aphelininæ parasitic on each insect attacked by this subfamily.

The larvæ of the North American sawflies, H. G. DYAR (*Canadian Ent., 27 (1895), No. 12, pp. 337-344*).—A popular artificial key to some 80 of the commoner species.

An attempt to correlate the results arrived at in recent papers on the classification of Lepidoptera, J. W. TUTT (*Trans. Ent. Soc. London, 1895, pt. III, pp. 343-362*).—A technical paper.

The classification of Lepidoptera on larval characters, H. G. DYAR (*Amer. Nat. 29 (1895), No. 348, pp. 1066-1072, pl. 1*).—The setæ of the larvæ are chiefly made use of, and many differences shown microscopically.

Notes on the subfamily Brachyscelinæ, with descriptions of new species,

W. W. FROGGATT (*Proc. Linn. Soc. N. S. Wales, ser. 2, 10 (1895), pp. 201–205, pl. 1*).—Technical descriptions of 3 new species of gall-making coccids.

On the vertical distribution of the Rhopalocera in the Alps, W. HARCOURT-BATH (*Entomologist, 28 (1895), No. 391, pp. 323–327*).—Brief note on the species of butterflies found in the different vertical zones.

Insects' eggs, M. V. BRANDICOURT (*Pop. Sci. Monthly, 48 (1895), No. 2, pp. 256–258, figs. 12*).—A translation from *La Nature* of a popular article on some oddly shaped eggs.

On the transformations of insects, L. C. MIALL (*Nature, 53 (1895), No. 1364, pp. 152–158*).

Notes on seasonal dimorphism of Rhopalocera in Natal, C. W. BARKER (*Trans. Ent Soc. London, 1895, pp. 413–428*).—Notes on several species, the deduction being that the changes are due to the alternate moisture and dryness.

The muscles of ants, wasps, and bees, C. JANET (*Compt. Rend., 121 (1895), No. 18, pp. 610–613, fig. 1*).

Secretion of caustic potash by Dicranura, O. H. LATTER (*Trans. Ent. Soc. London, 1895, pp. 399–412, pls. 2*).—The moths were found to dissolve their way from the cocoons by means of minute drops of caustic potash.

Mimicry of fungi in insects, W. G. FARLOW (*Bot. Gaz., 20 (1895), No. 12, pp. 547, 548*).—Examples are given of insects assuming the appearance of fungi—a probable means for protection.

The inmates and economy of the hive, A. GALE (*Agl. Gaz. N. S. Wales, 6 (1895), No. 10, pp. 693–697*).—Notes on bees, with special reference to drones.

The ventilation of bee cellars, G. M. DOOLITTLE (*Amer. Bee Jour., 36 (1896), No. 1, pp. 4–6, figs 3*).—An illustrated description of the writer's method of supplying bees with fresh air at 45° F.

Foul brood and its treatment, T. W. COWAN (*Jour. Roy. Agl. Soc. England, 6 (1895), No. 24, pp. 664–675*).

Cecidomyia atriplicis, T. D. A. COCKERELL (*Amer. Nat., 29 (1895), No. 8, pp. 766, 767*).—A description of the adult emerging from galls on *Atriplex canescens*.

The yellow stem fly (*Ztschr. landw. Cent. Ver. Sachsen, 1895, No. 11, pp. 421, 422*).—Notes on the cereal insect *Oscinis tæniopus*.

The basket caterpillar, or bagworm, J. W. TUTT (*Ent. Record, 7 (1895), No. 6, pp. 121–123, pl. 1*).—Brief notes on some larvæ from the Argentine Republic that seem to be quite near *Thyridopteryx ephemeræformis*.

Locusts and the horn fly, G. C. DAVIS (*Michigan Sta. Rpt. 1893, pp. 397–402, figs. 3*).—A reprint of Bulletin 98 of the station (E. S. R., 5, p. 311).

An unexpected apricot pest, C. G. BARRETT (*Ent. Monthly Mag., 1895, Dec., p. 278*).—A short note on the discovery of the larvæ of *Teras contaminana* feeding on half-grown apricots in England.

The plum-twig gall mite, M. V. SLINGERLAND (*Canadian Ent., 27 (1895), No. 12, pp. 329–333, pl. 1*).—Illustrated descriptive and remedial notes on *Phytoptus phlæocoptes*, spraying with strong kerosene emulsion during the dormant period, or else pruning and burning gall-bearing twigs being advised.

A new species of Coccidæ of the genus Diaspis, T. D. A. COCKERELL (*Act. Soc. Sci. Chile, 5 (1895), pp. 6, 7*).—A technical description of *Diaspis chilensis* on the leaves of a tree from Chile.

Contributions to Coccidology, T. D. A. COCKERELL (*Amer. Nat., 29 (1895), No. 8, pp. 725–732*).—Descriptions of 2 new species of Orthezia and a new variety of Dactylopius.

Miscellaneous notes on Coccidæ, T. D. A. COCKERELL (*Canadian Ent., 27 (1895), No. 9, pp. 253–261*).—Brief observations on 22 species with description of a new variety of Lecanium.

New species of Coccidæ, T. D. A. COCKERELL (*Supp. to Psyche, 1895, Sept., pp. 7, 8*).—Descriptions of 2 species of Aspidiotus, 1 of Dactylopius, and 1 of Eriococcus.

Scale insects liable to be introduced into the United States, T. D. A. COCKERELL (*Garden and Forest, 8 (1895), No. 409, p. 518*).—A general article naming the species of scale insects now in the United States that the writer considers as introduced by human agency, and stating that there are 130 species in the Tropics that may possibly be introduced in the future.

Notes on the geographical distribution of scale insects, T. D. A. COCKERELL (*Proc. U. S. Nat. Museum, 17 (1895), pp. 615–625*).—A brief popular résumé of some of the literature on the subject.

Injurious insects, T. D. A. COCKERELL (*Southwestern Farm and Orchard, 1895, Sept., pp. 11, 12; Oct., pp. 4, 5*).—A popular article first given as a lecture.

The grapevine typhlocybids of the Mesilla Valley, T. D. A. COCKERELL (*Supp. to Psyche, 1895, Dec., p. 14*).

The phylloxera in Europe, A. BLAVIA (*Agl. Gaz. N. S. Wales, 6 (1895), No. 10, pp. 690–692*).—A brief review of the situation in the principal European grape countries.

Tea pests and remedies, WATT (*Indian Agr., 20 (1895), No. 12, p. 384*).

Spraying by steam power, W. E. BRITTON (*Garden and Forest, 8 (1895), No. 407, pp. 497, 498*).—A short article describing the process of spraying elm leaf beetles with a force pump operated by a 6-horsepower steam engine. Arsenate of lead and glucose gave the best results.

Report of State Entomologist of Norway for 1894, W. M. SCHÖYEN (*State Agl. Rpt. Norway, 1894, pp. 49–82*).

FOODS—ANIMAL PRODUCTION.

Determination of the number of bacteria and mold spores in feeding stuffs, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 313, 314*).—The number of bacteria and mold spores was determined in 21 feeding stuffs, including cotton-seed cake and meal, cocoanut cake and meal, peanut cake and meal, linseed cake and meal, corn cake and meal, rape cake and meal, etc. From 1 to 95 trials were made with each of the feeding stuffs, and the number of bacteria and mold spores varied through wide limits.

The method used was the following: About 50 gm. of the feeding stuff was pulverized and 0.5 gm. of the powder placed in a flask containing about 20 cc. of sterilized water. The flask was shaken frequently for about ½ hour. Then with a pipette 1 cc. of the contents was placed in sterilized liquid meat peptone gelatin. After 2 or 3 days the number of colonies of bacteria was counted and the number of bacteria in 0.1 gm. of the feeding stuff determined, and further the number of bacteria which liquified the gelatin.

By a similar method, but using peanut gelatin instead of the meat peptone gelatin, the number of mold spores was determined. The method of preparing peanut gelatin is given. The results obtained are tabulated.

Concerning the gluten content of varieties of wheat and baking tests of wheat flour, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 213–223*).—The author's conclusions are as follows: The gluten content of wheat generally, but not always, rises and falls with the content of nitrogen. A constant relation between the baking

quality and the gluten content is not perceptible, so that in order to judge of a flour it is necessary to test the baking quality as well as to determine the gluten content. It is stated that comparable numbers for the baking qualities of varieties of wheat are obtained by multiplying the gluten content by the increase in volume which the gluten suffers during baking.

Rancid fat in commercial fodders, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 309–311*).—In judging of the freshness of feeding stuffs, the condition of the fat is an important consideration. The older the fodder the more rancid the fat becomes, although rancidity is also caused by microörganisms.

The author reports the results of examinations of the fat in a large number of feeding stuffs, including oil cakes, wheat and rye bran, brewers' grains, malt sprouts, cotton-seed meal, meat meal, rice meal, etc., from 1888 to 1892, inclusive. The method followed was to dissolve the ether extract obtained in the analysis in a mixture of equal parts of acid-free ether and alcohol, and titrate with twentieth-normal potash solution, using phenolphthalein as indicator. The result was calculated as oleic acid and reduced to 1 gm. of fat.

The author concludes that the fat of cocoanut, peanut, sesame, and rice feeding stuffs ordinarily contains considerable quantities of free fatty acids. The fat of cotton seed, sunflower seed, rape, and linseed feeding stuffs contains smaller quantities. Further, it is noticeable that with few exceptions the meals made from oil cake possess a greater rancidity than the cake itself, indicating that the poorer sorts of cake are usually ground into meal.

New contributions to the examination of rape-seed cakes, II–V, F. H. WERENSKIOLD (*Tidskr. norske Landbr., 2 (1895), pp. 273–285*).—The material examined was yellow mustard (*Sinapis arvensis*), Indian rape seed (*Brassica glauca*, *B. ramosa*, *B. dichotoma*, and *Sinapis juncea*), wild radish (*Raphanus raphanistrum*), rape (*Brassica napus*), summer rape (*B. rapa* or *campestris*), and black mustard (*B. nigra*).

Yellow mustard was found to contain myrosin, an alkaloid most likely identical with sinapin, sulfocyanid, and a glucosid which is different from sinigrin and sinalbin. The injection of a mixture of the glucosid and the alkaloid into rabbits caused almost instantaneous death, while guinea pigs lived about an hour after subcutaneous or intravenous injection of small doses of the mixture. If given through the mouth, the animals did not suffer from the doses. The quantities of these substances obtained were very small.

The composition of the Indian rape seed examined was as follows:

Composition of Indian rape seed.

	Brassica glauca.	Brassica ramosa.	Brassica dichotoma.	Sinapis juncea.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	5.14	6.14	5.74	6.16
Ash	3.65	4.55	6.43	5.32
Crude protein	22.00	22.44	21.00	24.63
Crude fiber	14.74	6.80	12.52	8.00
Nitrogen-free extract	10.05	21.02	13.08	20.38
Ether extract	44.44	39.05	41.23	35.51
Present as true albuminoids	84.36	84.42	89.00	87.58
Lecitnin (Schulse and Frankland's method)	3.75	3.45	2.76	2.04
Mustard oil obtained (Schlicht's method)	0.51	0.39	0.32	0.58
Sucrose:				
Gravimetric determinations	0.79	0.80	0.92	1.00
Polarimetric determinations	0.99	0.97	1.23	1.24

The presence of a nonreducing sugar in rape seeds has been shown by Dr. B. Gram. It is given as sucrose in the table, from the general reactions of its solutions.

The examination of wild radish failed to show the presence of any substances from which mustard oil or any other irritating principle was generated. The rape varieties have been previously examined. They all contain myrosin and potassium myronate (sinigrin), from which mustard oil is generated, summer rape containing the least, ordinary rape more, and black mustard the most of these. On this account the black mustard is considered unfit for cattle food. The determinations made by the author corroborated previous results.—F. W. WOLL.

Feeding experiment with molasses for milch cows (*Tidskr. Landtmän, 16 (1895), pp. 497–502*).—The experiment was conducted at Alnarp Agricultural College, Sweden. The composition of the molasses fed was as follows: Water 27.16 per cent, ash 8.40, crude protein 8.24 (true protein 0.25 per cent, amids 7.50, nitric acid 0.49), nitrogen-free extract 55.91, crude fat 0.29. The experiment was planned to study the comparative value of molasses and grain feed (ground oats and barley) as food for dairy cows. Twelve milch cows of the East Friesian breed were separated into 3 lots of 4 each. The cows were fed the following ration previous to the experiment: 20 kg. fodder beets, 5 kg. hay, 2 kg. ground feed, 1 kg. wheat bran, ½ kg. each of sunflower-seed cake and peanut cake, and ¼ kg. each of rape-seed cake and palm-nut cake. Lot 1 received this feed throughout the experiment; lot 2 was fed 1 kg. of molasses in addition to the preceding ration; and lot 3 was fed 1¼ kg. of molasses in place of 1 kg. of ground oats and barley. The experiment lasted from February 20 to May 10. Beginning April 10, the molasses in the rations of lots 3 and 4 was increased by 1 lb., and the sugar beets were replaced by a similar quantity of ensiled beet diffusion chips. On April 25, lots 2 and 3 were changed back to the

original ration without any molasses. The yields and fat content of the milk were as follows:

Milk yield and fat content of milk.

	Cows No. 1		Cows No. 2		Cows No. 3		Cows No. 4.	
	Milk yield	Fat in milk.	Milk yield.	Fat in milk.	Milk yield.	Fat in milk.	Milk yield.	Fat in milk.
Group I.	*Kg*	*Per ct*	*Kg.*	*Per ct*	*Kg.*	*Per ct.*	*Kg.*	*Per ct.*
February 20	15.1	3.10	12.4	3.60	12.0	2.80	16.7	3.00
April 30	13.5	2.95	12.4	3.20	10.9	2.60	16.0	2.80
May 10	13.0	2.90	12.0	3.40	10.4	2.70	16.6	2.60
Group II.								
February 20	15.2	2.75	15.7	3.00	13.7	3.70	12.5	3.10
April 30	14.8	3.00	14.0	2.75	13.8	3.40	11.7	3.10
May 10	14.8	3.00	13.6	3.00	12.5	3.45	11.8	3.00
Group III								
February 20	14.2	3.20	16.6	2.80	11.8	3.30	13.0	2.60
April 30	15.0	3.20	15.4	2.70	10.1	3.25	13.0	3.10
May 10	14.8	3.10	15.4	2.80	10.5	3.10	13.0	3.20

Lot 1 yielded 4.2 kg. less milk on May 10 than on February 20, or a decrease of 7.5 per cent due to the advance of the lactation period; lot 2 yielded 4.4 kg. less, or a decrease of 7.7 per cent, and lot 3 yielded 1.9 kg. less, or a decrease of 3.4 per cent. The cows increased in live weight during the experiment, the total gain for each lot being: Lot 1, 127 kg.; lot 2, 102 kg., and lot 3, 79 kg. The molasses was fed with the concentrated foods, and was eaten with a relish after the first few days. The quantity was regularly increased until the quantities to be fed during the experiment were reached.—F. W. WOLL.

Investigations on the bodily development of sheep, M. R. SÉNÉQUIER (*Ann. Agron., 21 (1895), No. 9, pp. 121–135*).—These investigations were made on 10 females of the milking breed of Larzac. Maturity, as shown by the completion of second dentition, was reached at from 38 to 41 months.

The average total increase from birth to maturity was 44 kg. The most rapid increase was during the first 2 months, and three-fourths of the entire increase was made during the first year. The gain was slower during the second year and still slower from the twenty-fifth month to maturity. The weight at birth varied between one-thirteenth and one-fourteenth of the average weight at maturity, near 2 months it was about one-third, at the fifth month one-half, between 6 and 7 months two-thirds, and between 8 and 9 months three-fourths of the adult weight.

The increase in height, measured at the throat, was very rapid the first month, a little less the second, and still less the third; and from this age to maturity the rise was very slow. During this experiment that portion of the height above the point of the olecranon doubled, while the portion below that point increased one half.

The size of the chest (perimeter), taken just back of the shoulders, had doubled at 8 months. The increase in size was marked during the

first 3 months, and quite small during the next 5 months. From the eighth to the seventeenth month the increase was only 5 cm., and from that time to maturity the gain was still smaller. The perimeter increased much more, relatively, than the height, especially toward maturity.

The length of the body, measured from the base of the skull to the base of the tail, increased much more rapidly the first year than the second, and remained stationary after the twenty-fourth month. The length doubled the first 12 months. At 12 months the height was equivalent to about two-thirds the length of the body. At birth the relative height was greater than this, but after 13 months it became less and remained so throughout life.

Food and diet, W. O. ATWATER (*U. S. Dept. Agr. Yearbook 1894, pp. 357–388, 547–558, charts 3*).—This article covers in a popular way much the same ground as Bulletin 21 of this Office. Some of the questions treated of are the nutritive ingredients of food, the digestibility of food, and dietary standards of people in various conditions. Many errors in ordinary food economy are pointed out, and tables are given showing the percentage composition of a large number of articles of food, the amount of nutrients contained in 10 cts. worth of various foods and food materials, and nutritive ingredients in a considerable number of daily dietaries.

The Federal meat inspection, D. E. SALMON (*U. S. Dept. Agr. Yearbook 1894, pp. 67–80*).—The following topics are treated: Growth of the inspection, diseases discovered by the inspection, reasons for condemning carcasses, advantages and disadvantages of large abattoirs, the cost of meat inspection, the importance of meat inspection, vessel inspection, stock-yards inspection, inspection in Great Britain of animals from the United States, and inspection and quarantine of imported animals.

Food and manure, Sir J. B. LAWES and Sir J. H. GILBERT (*Jour. Roy. Agl. Soc. England, 6 (1895), No. 21, pp. 116–129*).—This is the same as a chapter on food and manure in Agricultural Investigations at Rothamsted, England, during Fifty Years (U. S. Dept. Agr., Office of Experiment Stations Bul. 22), an abstract of which has been given (E. S. R., 7, 415).

The proteids of wheat, M. O'BRIEN (*Ann. Bot., 9 (1895), p. 171*).

Composition of the flour furnished by hard and soft wheats in the roller process, A. GIRARD (*Compt. Rend., 121 (1895), No. 25, pp. 922–929*).

On the composition of rice imported into France, BALLAND (*Compt. Rend., 121 (1895), No. 17, pp. 561–561; abs. in Chem. Centbl., 1895, II, No. 22, p. 1007*).—The maximum and minimum food constituents of Arracan, Carolina, India, Japan, Java, Piemont, and Saigon rice, uncleaned, dressed, and polished, are tabulated and discussed. It is shown that rice is a highly nutritious food, but that dressing and polishing reduce its nutritive value materially.

On the composition of meat extracts, J. KÖNIG and A. BÖMER (*Ztschr. analyt. Chem., 34 (1895), No. 5, pp. 548–567*).

The amount of iron in ordinary dietaries (*Diet. and Hyg. Gaz., 12 (1896), No. 1, pp. 24–26*).

Molasses for farm animals (*Nord. Mejeri Tidn., 10 (1895), pp. 316, 317*).—Practical experiences in feeding beet-sugar molasses to farm animals.

Dried-beet chips and molasses as stock foods, I. INSULANDER (*Nord. Mejeri Tidn., 10 (1895), pp. 327, 328*).

Peanut oil and meal, C. MERIWETHER (*Indian Agr., 20 (1895), No. 12, pp. 372, 373*).

Farm foods, or the rational feeding of farm animals, E. VON WOLFF (*Translated by H. H. Cousins. London: Gurney & Jackson, 1895, pp. XVI+365; reviewed in Nature, 53 (1895), No. 1360, p. 53*).

Simple methods for detecting food adulterations, J. A. BOWER (*London: Soc. for Promoting Christian Knowledge, 1895, pp. 118*).

Methods for the determination of ergot in flour and bread, M. GRUBER (*Arch. Hyg., 24, No. 3–4, pp. 228–235; abs. in Bot. Centbl., 64 (1895), No. 13, pp. 435, 436*).

Some facts regarding the products formed in the digestion of starchy foods (*Diet. and Hyg. Gaz., 11 (1895), No. 12, pp. 737–739*).

The coagulation of the albumen of meat by heating, J. H. MILROY (*Arch. Hyg., 25, No. 2, pp. 154–163*).

Further clinical investigations on the resorption and excretion of lime, J. G. REY (*Deut. med. Wochenschr., 21 (1895), p. 569; abs. in Chem. Ztg., 19 (1895), No. 85, Repert., p. 308*).

Functional assimilation, F. LE DANTEC (*Compt. Rend., 121 (1895), No. 25, pp. 950–953.*)

The chemistry of nutrition, E. POTT (*Unsere Nährungs Chemie. Munich: T. Ackermann, 1895, pp. 104; reviewed in Chem. News, 72 (1895), No. 1878, p. 255.*

Skim milk as food for calves, C. MARTIN (*Ind. Lait., 20 (1895), No. 49, p. 385*).

Skim milk as food for calves and pigs, T. CAROLL (*Ind. Lait., 20 (1895), No. 40, pp. 314, 315*).

Growth, nutrition, and profit from young cattle, F. LEFEVRE (*Ann. Sci. Agron., 2 (1894–'95), No. 1, pp. 1–24, charts 3*).

A test of linseed meal (*Breeders' Gaz., 1895, Dec. 11, p. 436*).—A record of gains made by steers having a large proportion of linseed meal in their ration.

Effect of oat straw on the yield of milk (*Landw. Centbl. Posen; Landw. Wochenbl. Schles. Holst., 45 (1895), No. 46, p. 643*).

Skim milk for milch cows (*Landmandsblade, 28 (1895), p. 341*).—A practical experiment showing that skim milk may be fed to milch cows with advantage. One lb. of concentrated feed (wheat and rye bran) was found to about equal 10 lbs. of skim milk. The milk must be fed gradually, thinning it with water, or feeding it mixed with concentrated feeds.

Milk and butter yield of several Holstein-Friesian cows, J. MESDAG (*Landbouw. Tijdschr., 1895, No. 6, pp. 321–328*).—The individual record is given for 3 herds containing 22, 12, and 12 cows, respectively.

The dairy herd—its formation and management, H. E. ALVORD (*U. S. Dept. Agr. Yearbook 1894, pp. 295–316*).—This is a popular article on the above subject, and treats of the types of dairy cattle, formation of the herd for special purposes, purebred dairy cattle and grades, the bull and his treatment, individuality and culling the herd by its record, accommodation for the herd, health of the herd, drying-off cows and calving time, abortion and milk fever, care of calves and young stock, attendance and milking, the pasture season and soiling, the stabling season, and feeding the herd.

The yield of the dairy herd at Ladelund during 1894 (*Landmandsblade, 28 (1895), pp. 375–381*).—The yield of milk and butter, live weight of cows, cost of products and of feed are given in the table for 25 cows for 1894, and for 10 cows for 1893–'94. Highest milk yield per year 9,033 lbs., and highest butter yield per cow 352.8 lbs. Average yields of milk and of butter for cows in the herd a full year 7,036 and 270 lbs., respectively.

Live weight, food requirements, and milk production of the cow, B. MARTINY (*Fühling's landw. Ztg., 44 (1895), No. 22, pp. 703–711*).—This article is chiefly concerned with the relative economy of milk production from large and small cows and large and small breeds.

On keeping, feeding, and disposing of swine in diary husbandry, M. HERTER (*Deut. landw. Presse, 22 (1895), Nos. 91, pp. 826, 827; 92, p. 838*).

Swine raising in Denmark, G. E. SCHANKE (*Tidskr. norske Landbr., 2 (1895), pp. 365–372*).

Experiments in swine feeding, KLEIN (*Abs. in Deut. landw. Presse, 22 (1895), No. 84, pp. 763, 764*).—The foods compared were barley and Indian corn.

Feeding wheat and corn to pigs, C. M. CONNER (*Amer. Agr.* (*middle ed.*), *1895, Nov. 23, p. 452*).—A summary of experiments at the Missouri Experiment Station.

Capacity for production of East Friesian milk sheep, RAMM (*Landw. Jahrb., 24* (*1895*), *No. 6, pp. 937–958*).

Experiments in fattening lambs with peanut cake and sesame cake, R. HEINRICH (*Zweiter Ber. Landw. Vers. Stat. Rostock, 1894, pp. 315–327*).—These experiments have already been referred to (E. S. R., 3, p. 266).

Slaughter experiments, C. LEHMANN (*Deut. landw. Presse, 22* (*1895*), *Nos. 79, pp. 715–717, figs. 6; 81, p. 735, figs. 4; 85, pp. 771, 772; 88, p. 798; 89, pp. 807–809, figs. 9*).

Poultry management on the farm (*Garden and Field, 21* (*1895*) *No. 6, p. 169*).—A general article on selection of stock, houses, general management and feeding, and diseases. Andalusians are preferred for egg laying, and Malays for market.

The penetration of typhoid bacilli into hen's eggs, PIORKOWSKI (*Arch. Hyg., 25, No. 2, pp. 145–153*).

Report on the work of the fish-culture station at Fecamp, 1893–'94, RAVERET-WATTEL (*Bul. Min. Agr. France, 14* (*1895*), *No. 5, pp. 565–569*).

Green oysters, D. CARAZZI (*Nature, 52* (*1895*), *No. 1357, p. 643*).—A controversial article in which the coloring matter, marennin, is stated to be chiefly iron salts, and believed to be due to an assimilation of nutritive substances from the sea bottom by parts of the epithelium and carried to the liver by amœbocytes.

VETERINARY SCIENCE AND PRACTICE.

An infectious disease among turkeys caused by protozoa (infectious entero-hepatitis), T. SMITH (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 8, pp. 7–38, pls. 5*).—The special characters of the disease, the microörganism (*Amœba meleagridis* n. sp.), the relation of bacteria to the disease, and the relation of this disease to certain other diseases of poultry are discussed, and the appendix gives detailed notes on 52 turkeys examined. The primary seat of the disease was in the cæca; the liver was also generally affected, being greatly enlarged and marked on its surface with roundish discolored spots distinctly demarcated from the surrounding tissue. The disease may take 3 courses:

"(1) After a certain period of disease regenerative processes begin which tend toward a permanent recovery.

"(2) The disease may proceed so rapidly from the very start that the affected turkeys die early in life.

"(3) The disease may come to a standstill, but the amount of dead tissue in the cæca and liver may be so great as to favor the entrance of bacteria which are responsible directly for the death of the bird late in the summer or fall. . . .

"The disease process is always associated with a protozoan parasite of a very minute size. . . . It is probably discharged with the droppings of the diseased birds."

Quinine is suggested as a suitable drug to be used in experiments in the treatment of this disease. The premises which have been inhabited by diseased fowls should be thoroughly disinfected.

A preliminary investigation of diphtheria in fowls, V. A. MOORE (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 8, pp. 39–62, pl. 1*).—The author summarizes the results of this investigation as follows:

"(1) Many of the so-called diseases of fowls which are characterized by an affection of the mucous membranes of the head, and popularly designated as 'roup,'

diphtheria, influenza, and sometimes cholera, resemble each other so closely in their manifestations that they may be considered as belonging to one and the same disease. This disease is distinct from the rapidly fatal malady which is better known as fowl cholera.

"(2) The lesions, as usually encountered, are diphtheritic in nature. In the advanced stages the accumulating exudates decompose and emit a putrid odor. In the earlier stages they are frequently of a serous or muco-purulent character, and not infrequently fowls die before the diphtheritic condition appears.

"(3) The same species of a pathogenic bacillus is associated with apparently different forms of lesions, more particularly in the serous or muco-purulent and diphtheritic. This bacillus is not distinguishable from the one described by European writers as the cause of fowl cholera, and can not be differentiated in parallel cultures from the bacillus of swine plague. It is comparable in certain respects with the supposed specific organisms of certain diphtheritic diseases of poultry and birds. Its causal relation to this disease, however, is not demonstrated.

"(4) This disease usually runs a slow, chronic course, from which the majority of the affected fowls recover. Its long duration enables the lesions to be more or less modified from the effect of external contamination. Outbreaks in which the disease runs a rapidly fatal course are reported, but thus far they have not been encountered in the investigations of this Bureau.

"(5) This disease, or, as may subsequently be found, diseases, is amenable to treatment. The treatment consists largely in good hygiene, and the removal of the accumulated exudate when the disease has reached the advanced stage. The local application of disinfectants is indicated.

"(6) A large number of slight or more severe enzoötics among fowls, due to local unsanitary conditions, are popularly considered as outbreaks of some contagious disease.

"(7) Judging from the results of these investigations and the recorded experience of certain poultry raisers, it is highly probable that this malady would have been prevented in a large proportion of the flocks in which it now exists if careful sanitary methods had been followed and precautions taken against the introduction of the disease through the purchase of affected fowls."

A study of a bacillus obtained from three outbreaks of fowl cholera, V. A. MOORE (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 8, pp. 63–70*).—The bacillus and the nature of the inoculation disease are described, and the difference between the bacillus of this disease and that of fowl cholera (rabbit septicæmia or swine plague) is discussed.

On a pathogenic bacillus of the hog-cholera group associated with a fatal disease in pigeons, V. A. MOORE (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 8, pp. 71–76*).—The history of the disease is traced and the bacillus is described. The author summarizes as follows the most important results of the investigation:

"(1) The discovery of a member of the hog-cholera group of bacteria apparently as the etiological factor in a chronic disease of pigeons.

"(2) The appearance in pure culture of a variety of the hog-cholera bacillus from the exudate covering a portion of the brain of a pigeon killed in the last stages of the disease popularly known as 'megrims.'

"(3) The presence of a marked indol reaction in cultures of a decidedly pathogenic bacillus of the hog-cholera group.

"(4) The discovery of a variety of the hog-cholera bacillus in which the cultural characters and the physiological property of producing indol tend to assimilate to a

marked degree those of closely related saprophytic forms, but which in its pathogenesis for experimental animals falls but little below that of the virulent form originally described. This striking commingling of saprophytic tendencies and highly parasitic powers tends to strengthen the proposed theory that the hog-cholera bacillus is derived from the closely related colon group of bacteria."

The absorption of abrin by mucous membranes, RÉPIN (*Ann. Inst. Pasteur, 9 (1895), No. 6, pp. 517–523*).

On the charbon toxin, L. MARMIER (*Ann. Inst. Pasteur, 9 (1895), No. 7, pp. 533–574*).

Immunization of rabbits against the streptococcus of erysipelas, and treatment of erysipelous affections by blood serum from vaccinated animals, D. GROMAKOWSKY (*Ann. Inst. Pasteur, 9 (1895), No. 7, pp. 621–624*).

Poisoning of domestic animals by nitrate of soda (*Ind. Lait., 20 (1895), No. 36, p. 283*).

The poisoning of cattle by eating the green plants of Lathyrus clymenum, E. SCHRIBAUX (*Jour. Agr. Prat., 59 (1895), No. 28, pp. 52–55*).—This plant, of which the seed were sold as common vetch, produced plants which, eaten green, caused the death of a number of animals.

Some practical suggestions for the suppression and prevention of bovine tuberculosis, T. SMITH (*U. S. Dept. Agr. Yearbook 1894, pp. 317–330, pl. 1*).—Character of the disease, contagiousness of the disease, preventive measures, and bovine tuberculosis in its relation to the public health are the topics treated.

Tuberculosis in domestic animals and its prevention, F. A. ZÜRN (*Die Tuberkulose der Haustiere und deren Vorbeuge. Leipsic: 1895, pp. 32; noticed in Milch Ztg., 24 (1895), No. 16, p. 256*).

Consumption considered as a contagious disease, A. L. BENEDICT (*Pop. Sci. Monthly, 1895, Nov., pp. 33–39*).

Concerning ulceration with and without microörganisms, W. POLIAKOFF (*Centbl. Bakt. und Par. Med., 18 (1895), No. 2–3, pp. 33–47*).

Veterinary materia medica for farmers, E. P. NILES (*Virginia Sta. Bul. 43, pp. 101–109*).—This is a popular article, defining a number of common medical terms, and describing the mode of action of gentian, ginger, nux vomica, iron, aloes, gamboge, jalap, Epsom and Glauber salts, oils, spirits of nitrous ether, buchu, and nitrate and acetate of potassium.

Regulations for dairy herds (*Breeders' Gaz., 1895, Nov. 6, p. 331*).—Regulations of the Illinois State Board of Health relative to barns, contagious diseases of milch cows, and adulteration of milk.

Rules and regulations governing the operations of the Bureau of Animal Industry (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 9, pp. 46*).—This contains the text of orders, regulations, and acts of Congress relative to the inspection and transportation of live stock and the inspection of meat.

DAIRYING.

The composition of the fat of cheese made from cows', goats', and reindeer's milk, E. SOLBERG (*Tidskr. norske Landbr., 2 (1895), pp. 330–338*).—At the Christiania Experiment Station the author investigated the composition of the fat in cheese made from cows', goats', and reindeer's milk, with a view to recognizing each kind in samples of cheese of unknown origin. The determinations of the melting and solidifying points, specific gravity at 15° C. and at 100° C., refraction index, acid saponification numbers, Hehner's, Reichert's, or Hübl's

numbers in the fat of cheese made from cows' and goats' milk showed but slight differences in these. The results obtained with fat from pure goats' milk cheese were as follows:

Fat of goats' milk cheese, 1893–'94.

	Melting point	Solidifying point.	Sp. gr at 15° C.	Sp gr. at 100° C.	Refractive index.	Acid number	Saponification number.	Hehner number	Reichert number	Iodin number.
	° C.	° C.								
Maximum	38.5	34.0	0.9361	0.8690	1.45995	13.88	229.1	87.34	25.4	34.6
Minimum	27.0	24.0	0.9268	0.8655	1.45890	3.95	216.7	86.46	23.1	30.4
Average	27.7–36.9	25–32.8	0.9312	0.8669	1.45958	8.47	221.6	86.87	24.6	32.4

As none of the determinations showed any appreciable difference between fat from cows' milk and from goats' milk, the insoluble fatty acids of the goats' milk fat were examined with the following results: Melting point 42 to 41° C., solidifying point 36 to 39° C., refractive index 1.4473 [37°], saponification number 219.6, and iodin number 34.6. These results also failed to disclose any characteristic method of discriminating between fat from cows' and goats' milk. The author found that the amounts of volatile insoluble acids in the 2 kinds of fat differ, goats' milk fat containing a larger quantity than fat from cows' milk. In a sample of cows' milk fat, 25 cc. of volatile soluble acids were found by Reichert's method, and 28.6 cc. in one of goats' milk fat. To another portion of the distillate, alcohol was added and the solution titrated, showing the content of volatile insoluble fatty acids to be 5 cc. for the goats' milk fat and 1.8 cc. for the cows' milk fat. Other determinations gave 5.97 and 6.11 cc. for goats' milk fat and 2.98 and 2.51 cc. for cows' milk fat. The method of distillation with steam was tried in order to obtain greater differences if possible between the 2 kinds of fat. Instead of distilling over 110 cc. in the course of half an hour, 800 cc. was distilled over with steam in 4 hours, the insoluble acids collecting on the filter through which the distillate was passed and in the condenser were washed with a little cold water, dissolved in alcohol, the solution united with the filtered distillate, and the whole titrated. In 5 gm. of material the distillate from goats' milk fat required 17.39 and 17.29 cc. decinormal alkali for neutralization, and that from cows' milk fat required 6.82, 8.62, 7.74, and 8.08 cc.

The discrimination between the 2 kinds of fat is especially important in the countries of northern Europe, where goats' milk cheese is a highly prized and comparatively expensive article of food, and is often adulterated with cows' milk.

Fat from reindeer's milk cheese.—The fat from a sample of cheese made from reindeer's milk (for composition see E. S. R., 6, p. 82) was examined by the different methods, with the following results:

Fat from reindeer's milk cheese.

	Melting point	Solidifying point.	Sp. gr. at 15° C	Sp. gr. at 100° C	Refractive index.	Acid number.	Saponification number.	Hehner number.	Reichert number	Iodin number
	° C.	° C.								
Fat from reindeer's milk cheese	7-42	34-39	0.94284	0.8640	1.40465	27.60	219.2	86.89	31.4	25.1
Insoluble nonvolatile acids from same..........	46-47	43 44	......	....	[1] 1.4395	....	......	......	......	26.6

[1] 46° C.

The insoluble volatile acids, obtained by Reichert's method from 5 gm. of fat, required 1.22 and 1.42 cc. decinormal alkali for neutralization. Distilled over with steam, as previously described, 3.83 and 3.90 cc. of alkali were required, thus showing a marked difference in this respect from the insoluble volatile acids of fat from cows' or goats' milk.

The lecithin content of the fat from reindeer's milk was 0.21 per cent.—F. W. WOLL.

On formalin as a milk preservative, S. RIDEAL (*Analyst, 20 (1895), No. 232, pp. 157-159*).—The author found that with 1 part of formalin to 10,000 of milk the milk remained fresh for 7 days. The formalin used for preserving milk in the trade he found to contain 5 oz. of pure formalin to the gallon. Of this, ½ pint was used to 17 to 18 gal. of milk, corresponding to 1 cc. of formalin to 18,432 cc. of milk, or 1 part formaldehyde to 46,080 milk.

"This does not impart any taste or smell to the milk even after boiling. In this strength the milk keeps fresh for at least 3 days. . . . I consider that formalin is much to be preferred to borax or boric acid as a milk preservative, seeing that the quantity required is so much smaller, viz, 1 oz. of formaldehyde as against 5 lb. of borax and boric acid. Its volatility is distinctly in its favor, as the small quantity present is evaporated on warming the milk. As to its toxic action, I have not heard of any ill effects, and have myself repeatedly drunk the 1 per cent solution, while that used for milk preservation is almost tasteless. For cream a slightly stronger solution is used; and in this connection it may be interesting to note that the use of salicylic acid in conjunction with the borax powder has increased in the last year or two, being present to the extent of 5 to 10 per cent in some preservatives, mixed with saccharin to mask the taste."

The detection and estimation of formalin in milk is discussed briefly. For the detection Schiff's reagent (magenta bleached by sulphurous acid) is found of use.

The dairy, M. C. (*Belg. Hort. et Agr., 7 (1895), No. 23, pp. 361, 362*).—The last part of a continued article dealing with the economic side of the subject.

Concerning the constancy of bacterial species in fore milk, H. L. BOLLEY (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 22-23, pp. 795-799*).

Cheese-curd inflation—its relation to the bacterial flora of fore milk, H. L.

BOLLEY and C. M. HALL (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 22–23, pp. 788–795, figs. 8*).

Typhoid fever disseminated through the milk supply, H. L. RUSSELL (*Science, 1895, Nov. 15, pp. 682, 683*).—An account of an epidemic at Stamford, Connecticut, in 1895.

Diseases conveyed by milk, B. LEE (*Agriculture of Pennsylvania, 1894, pp. 140–146*).—General remarks on the subject, with reference to some specific cases. The author advocates milk inspection, but believes dairy inspection to be of quite as much importance as inspection of quality.

On the qualities of cows' milk produced on potato slump, and its adaptability for infants, K. F. BECK (*Leipsic: G. Wittrin, 1895; abs. in Centbl. agr. Chem., 24 (1895), No. 10, p. 669*).

Condensed milk, O. STJERNQUIST (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 185–193*).—A historical sketch.

Report of trials of the "Radiateur," M. H. FRIANT and M. V. HOUDET (*Ind. Lait., 20 (1895), No. 48, pp. 377–379*).

Improvements in and connected with the sterilization and preservation of milk, cream, and other fluids, T. R. MASON (*Jour. Soc. Chem. Ind., 14 (1895), No. 10, p. 880*).—A patented process.

Improvements in process of and apparatus for condensing and preserving milk, B. F. MCINTYRE (*Jour. Soc. Chem. Ind., 14 (1895), No. 10, p. 880*).—A patented process.

Improvements in the utilization of skim milk and the like, H. CHRISTENSEN and R. HAMANN (*Jour. Soc. Chem. Ind., 14 (1895), No. 10, p. 881*).

The pasteurization and sterilization of milk, E. A. DE SCHWEINITZ (*U. S. Dept. Agr. Yearbook 1894, pp. 331–356, figs. 28*).—This includes remarks on the changes in milk, the number of germs in milk, the desirability of sterilizing or pasteurizing, its effect on digestibility, and the preparation of milk for infants and invalids on a small scale and on a commercial scale, with an illustrated description of the methods of pasteurizing and sterilizing milk, showing the need of such treatment.

Improvements in and apparatus for sterilizing milk, F. GUILLEAUME and E. GOLDSTEIN (*Jour. Soc. Chem. Ind., 14 (1895), No. 10, p. 880*).—A patented process.

Milk inspection and milk standards, H. LEFFMANN (*Agriculture of Pennsylvania, 1894, pp. 127–132*).—A popular discussion of the subject, including the sanitary inspection, and extracts from the writings of numerous authorities.

Milk inspection and milk standards, C. B. COCHRAN (*Agriculture of Pennsylvania, 1894, pp. 132, 133*).—Brief remarks on the subject.

Milk inspection and milk standards, G. ABBOTT (*Agriculture of Pennsylvania, 1894, pp. 151–159*).—The author asks why more should be required of milk producers than of other dealers in food products. He believes it to be of more importance that milk should be produced and kept under good sanitary conditions than that it should contain a specified quantity of solids and fats; and he deprecates the attempt to suppress the sale of skim milk.

TECHNOLOGY.

Analysis of lard and of similar fats; researches on vegetable oils, F. JEAN (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 15, pp. 780–784*).

Sunflower oil, D. HOLDE (*Mitt. Tech. Vers-A. Berlin, 12 (1894), p. 36; abs. in Jour. Chem. Soc., 1895, Aug., p. 335*).

Experiments with precipitation by barium chlorid in sugar making, H. C. P. GEERLIGS (*West Java Sugar Sta. Contr. 17, pp. 21, 22*).

Clarification of sugar-cane juice in Louisiana, W. P. KIRCHHOFF and F. C. THIELE (*Chem. Ztg., 19 (1895), No. 81, pp. 1830, 1831*).

The glucose content of sugar refuse, H. C. P. GEERLIGS (*West Java Sugar Sta. Contr. 19, pp. 49*).

Sake brewing and sugar production through bacteria, C. WEHMER (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 15–16, pp. 565–581*).

On the manufacture of milk sugar, G. ZIRN (*Milch Ztg., 24 (1895), Nos. 30, pp. 481–483; 31, pp. 497–499*).

Preparation of table sirups, H. E. HORTON (*Scientific Amer., 1895, Nov. 9, p. 294*).

A contribution to the study of the production of the aroma in rum, P. H. GREG (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895), Nos. 8, pp. 153–157; 9, pp. 192–195*).

The examination of cherry brandy, K. WINDISCH (*Arb. Kais. Gesund. Amt., 11, p. 285; abs. in Ztschr. angew. Chem., 1895, No. 13, p. 394*).

Examination of Moselle wines of the vintage of 1892 and 1893, F. MALLMANN (*Ztschr. angew. Chem., 1895, No. 12, pp. 341–345*).

The composition of Samoan wines used in the manufacture of vermuth, CAZENEUVE and HUGOUNENQ (*Bul. Soc. Chim. Paris, 13–14 (1895), No. 11, p. 601*).

Free and aldehyde sulphurous acid in wine (*Jahresber. chem. Ind.; abs. in Chem. Ztg., 18 (1894), No. 56, p. 1069; 19 (1895), No. 34, p. 771*).—A review of the recent work done on the subject.

On the gum of wine, G. NIVIÈRE and A. HUBERT (*Compt. Rend., 121 (1895), No. 8, pp. 360–362*).

A contribution to the morphological study of the ferments of the wine of Valpantena, V. PEGLION (*Staz. Sper. Agr. Ital., 28 (1895), No. 6, p. 369*).

Vinegar from honey (*L'Apiculteur, 39 (1895), No. 11, pp. 115, 116*).—A report of a successful experiment in which honey was mixed with 10 parts of water and exposed to the air and sun during the summer months, there resulting a clear, light-yellow vinegar of excellent flavor, with a specific gravity of 1.001 and containing 3.36 per cent of acetic acid.

New rubber industry at Lagos (*Kew Misc. Bul. No. 106, pp. 241–247, pl. 1*).—This deals with a botanical description of *Kickxia africana*, the process of obtaining rubber from it, and statistics of the rubber industry in west Africa.

Report on a tannin from an exudation of Pterocarpus draco, known in Jamaica as dragon's blood, H. TRIMBLE (*Amer. Jour. Pharm., 67 (1895), No. 10, pp. 516–518*).—The substance contains 34.85 per cent tannin, resembling oak-bark tannin chemically.—W. H. KRUG.

Hop tannin and phlobaphene, M. M. HAYDUCK (*Centbl. agr. Chem., 24 (1895), p. 285; from Wochensch. Brauer., 11 (1894), p. 409; abs. in Jour. Chem. Soc., 1895, Sept., p. 470*).

Mid-European nutgalls and Scrophularia nodosa, F. KOCH (*Arch. Pharm., 233 (1895), pp. 48–99; abs. in Jour. Chem. Soc., 1895, Oct., p. 109*).

AGRICULTURAL ENGINEERING.

An experiment with a country road, C. H. PETTEE (*New Hampshire Sta. Bul. 30, pp. 19, pls. 3, figs. 2*).—"Advantage has been taken of the necessity of straightening and otherwise repairing certain portions of the highway adjacent to the college farm to carry out an experiment in road construction." Different portions of the road selected were constructed in different ways. "Notes will be taken from time to time on the condition of the different parts of the road, that comparative results may be reported later." The details of construction and cost are reported, and suggestions regarding road making and management are given under the following heads: Cost; permanent work; apparatus; grade level; road construction, including grade, drainage, foundation, and surfacing; repairs; and records.

Draining for profit, A. C. SISSON (*Agriculture of Pennsylvania, 1894, pp. 307–310*).

Winter irrigation, J. W. GREGORY (*Irrigation Age, 8 (1895), No. 8, p. 239*).

Profitable irrigation by hydraulic rams, E. C. WARNER (*Amer. Agr.* (*middle ed.*), *1896, Jan. 18, p. 58*).

Water supplies for irrgation, F. C. FINKLE (*Irrigation Age, 11* (*1896*), *No. 1, pp. 4-7*).

The art of irrigation, T. S. VAN DYKE (*Irrigation Age, 11* (*1896*), *No. 1, pp. 8-12, fig. 1*).—This article deals with choice of methods and preparation of the ground.

Irrigation becoming general (*Irrigation Age, 11* (*1896*), *No. 1, pp. 22, 23, fig. 1*).—A brief popular article.

Electric plowing in Germany (*Indian Agr., 20* (*1895*), *No. 12, p. 375; abs. in London Electrical Engineer*).

Machines for harvesting sugar beets, RINGELMANN (*Jour. Agr. Prat., 59* (*1895*), *Nos. 44, pp. 624-634, figs. 21; 45, pp. 666-669*).

Report on American agricultural implements based on observations at Chicago in 1893, F. SCHOTTE (*Landw. Jahrb., 24* (*1895*), *No. 6, pp. 909-936*).

Tests of agricultural machines and implements, P. VON SCHILLER, SCHACHT, WERNICH (*Landw. Wochenbl. Schles. Holst., 45* (*1895*), *No. 43, pp. 593, 594*).

The width-of-tires act of western Australia (*Jour. Bur. Agr. Perth, 2* (*1895*), *No. 24, p. 601*).

Structure of roads, S. R. DOWNING (*Agriculture of Pennsylvania, 1894, pp. 326, 327*).

Best roads for farms and farming districts, R. STONE (*U. S. Dept. Agr. Yearbook 1894, pp. 501-504, figs. 7*).—A brief discussion, with illustrations, of the kind of road best adapted to the needs of the farmer, and suggestions regarding the maintenance of roads.

State highways in Massachusetts, G. A. PERKINS (*U. S. Dept. Agr. Yearbook 1894, pp. 505-512*).—Treats briefly of first efforts to improve roads in this State, provisions of the road law, apportionment of roads, methods of road construction, property rights, etc.

Improvement of public roads in North Carolina, J. A. HOLMES (*U. S. Dept. Agr. Yearbook 1894, pp. 513-520, pls. 2*).—This includes an historical sketch, and notes on improvement in the several counties and on road materials.

STATISTICS.

Sixth Annual Report of Michigan Station (*Michigan Sta. Rpt. 1893, pp. 54-90*).—This includes outlines of work in the different departments of the station, and a report of treasurer for the fiscal year ending June 30, 1893.

The world's markets for American products—Netherlands (*U. S. Dept. Agr., Section of Foreign Markets Bul. 5, pp. 76*).—Among the principal topics treated are area and population, wealth and debt, climate and soil, methods of soil cultivation, meadows and pastures, statistics of live stock, number and average size of farms, prices of farm lands and annual rental, fisheries, sugar industry, colonial production of tobacco and cinchona, consumption of tobacco per capita, shipping and navigation, commerce, customs tariff, and statistics of agricultural and other products imported into the Netherlands. A report from the United States consul at Rotterdam is incorporated.

Monthly crop report, October, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 131, n. ser., pp. 20*).—Condition and average yield of the principal crops in 1894, temperature and rainfall, report of European agents, and transportation rates.

Monthly crop report, November, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 132, n. ser., pp. 14*).—Condition and estimated average yield per acre of the principal crops in 1895, and transportation rates on fertilizers from the principal cities to numerous localities in the Cotton Belt.

Education and research in agriculture in the United States, A. C. TRUE (*U. S. Dept. Agr. Yearbook 1894, pp. 81-116*).—This paper gives the origin and development

of agricultural institutions in the United States, including the first plans for agricultural education, Washington's message to Congress, agricultural fairs at Washington, cattle show in Massachusetts, hindrances to agricultural education (1810–'40), revival of interest in agriculture, plans for agricultural education in New York and other States, the first agricultural college, the first Morrill act, the events leading up to the Morrill act, the origin and development of the U. S. Department of Agriculture, the agricultural experiment stations, establishment of the Office of Experiment Stations, and the second Morrill act; and an account of the present status of agricultural education and investigation in the United States, consisting largely of statistics on the colleges having courses in agriculture, the agricultural experiment stations, and the Office of Experiment Stations, with remarks on the work of each of these.

On the introduction of courses in dairying in the curriculum of veterinary students, OSTERTAG (*Ztschr. Fleisch- und Milchhyg., 6, No. 1, pp. 1–3*).—The author argues from the growing importance of dairy questions from a veterinary standpoint that the veterinary course should include instruction in milk and its uses. He outlines the following course as embodying the knowledge of dairying necessary to the veterinarian: (1) Physiology of milk, with special reference to the effect of breed, feed and care of the cow, and other conditions on the fat content of milk; (2) handling of milk and the different dairy products; (3) abnormal milk—(*a*) milk from cows irrationally fed, sick, or treated with medicines, and (*b*) infection of the milk by pathogenic and saprophytic microörganisms; (4) rational milk production in general and in milk-cure institutes; (5) pasteurizing and sterilizing, and (6) milk control—(*a*) on the farm by examination of the cows, inspection of feeding stuffs, milking, and the treatment of the milk, and (*b*) market and laboratory control.

Yearbook of the Department of Agriculture, 1894 (*U. S. Dept. Agr. Yearbook 1894, pp. 608, pls. 7, figs. 140*).—This includes the report of the Secretary of Agriculture, numerous semipopular articles noted elsewhere, and an appendix containing information on the organization of the Department, the experiment stations and agricultural colleges, agricultural statistics, composition and use of human and animal foods, fertilizers and manures, the control of injurious insects, grasses as sand and soil binders, weeds, and a list of farmers' bulletins. The volume contains a comprehensive index.

The Yearbook of the Department of Agriculture (*Garden and Forest, 8 (1895), No. 400, pp. 421, 422*).—An editorial review.

The British harvest of 1894 (*Jour. [British] Bd. Agr., 1 (1895), No. 3, pp. 273–275*).

Agriculture in Victoria (*Jour. [British] Bd. Agr., 1 (1895), No. 3, pp. 284–286*).—Summary of the final report of the Vegetable Products Commission of the Colony of Victoria.

Exports of British cattle in 1894 (*Jour. [British] Bd. Agr., 1 (1895), No. 3, pp. 292–294*).

Imports and exports of agricultural produce in 1894 (*Jour. [British] Bd. Agr., 1 (1895), No. 3, pp. 368–379*).—Statistics for Great Britain.

Rothamsted memoranda, 1895 (*pp. 87*).—These memoranda as usual contain statements regarding the origin, scope, and plan of the Rothamsted experiments, with summaries of the results of these experiments, to which is appended a list of papers on the experiments published since 1847.

NOTES.

CALIFORNIA STATION.—By an act of the State legislature the State Viticultural Commission was abolished on January 1, and its property, including a library of 1,000 volumes, was transferred to the experiment station. The duties of the commission now devolve upon the station, and an appropriation of $2,500 has been given by the State for the purpose of carrying out the objects for which the commission was established.

MINNESOTA COLLEGE AND STATION.—A poultry house has been erected and equipped, and experimental and instructional work in poultry, in charge of J. M. Drew, will be carried on by the college and station. The northwest subexperiment farm, located at Crookston last summer, has been fitted up with some commodious farm buildings and placed under the superintendence of T. A. Hoverstad, B. Agr., assistant in agriculture. A subexperiment farm is to be chosen in the northeastern part of the State with special reference to growing field and garden crops in the pine regions. Some forestry work will also be attempted, as well as general and stock farming. The Minnesota dairy school has just closed a successful session, with 98 students in attendance. The work was carried on in the new dairy house, which proved to be well adapted for the purpose. An agricultural school for women will again be held in May and June.

MISSOURI STATION.—C. M. Connor, B. Agr., B. S., has been appointed assistant in agriculture. An entomological laboratory has been equipped for the station and college, and a horticultural laboratory has just been completed at a cost of $5,000.

NEW JERSEY STATIONS.—Director E. B. Voorhees, of the College Station, has been chosen also director of the State Station. The college farm has been turned over to the stations for experimental purposes, and it is the intention to broaden the work of the stations in horticulture and dairying. A greenhouse plant has already been erected, consisting of a head house of two stories, 20 by 30 ft.; two glass houses, each 20 by 50 ft., and one 10 by 28 ft. An experimental orchard of 5 acres has also been planned to include small fruit. A. T. Jordan has been appointed assistant in horticulture.

PENNSYLVANIA COLLEGE AND STATION.—In November, 1895, Col. J. A. Woodward was appointed by the Pennsylvania State College as superintendent of its Chautauqua course of home reading in agriculture. There have been enrolled about 150 new members in the course, including agricultural editors, principals of private schools of a high grade, and physicians, as well as prominent and successful farmers. The Pennsylvania State Department of Agriculture has commissioned the director of the station to conduct experiments upon the culture and curing of tobacco. The work will be substantially a continuation of that which has been carried on in two different localities of the State for the past two years under the general supervision of the State.

SOUTH CAROLINA COLLEGE AND STATION.—L. A. Clinton, assistant professor of agriculture in the college and assistant agriculturist of the station, resigned January 1 to accept a similar position at Cornell University. W. E. A. Wyman, V. S., has been elected veterinarian of the station and will assume his duties the middle of February.

PERSONAL MENTION.—H. Marshall Ward has been elected to the professorship of botany in the University of Cambridge, vacated by the death of Professor Babbington.

Dr. Ritzema-Bos has been chosen professor of phytopathology and director of the Phytopathological Laboratories of the University of Amsterdam.

Dr. G. Lagerheim has been chosen professor of botany and director of the Botanical Institute of the University of Stockholm.

M. S. Bebb, the greatest American authority on willows, died December 5, 1895, at San Bernardino, California.

EXPERIMENT STATION RECORD.

VOL. VII. NO. 7.

The question as to the manner in which food is utilized in the body in the production of energy has received much attention from time to time, and has become of added general interest as the investigation has advanced and some practical results been attained. Investigation of this character is exceedingly intricate, and there is great liability to form incorrect conclusions. The point of view is changing from time to time with the accumulation of data and improvement in the methods of work. An impartial summary showing the present status of investigation of this subject can hardly fail to be of interest and value to many. Such a review by Professor Zuntz, professor of animal physiology in the Royal Agricultural High School at Berlin, and an eminent investigator and student in this line, is given in the present number of the Record. It is believed that in the main this article can be taken as presenting without bias the latest views which have been advanced on the subject of metabolism and the production of energy in the animal body.

In these investigations the respiration apparatus has been extensively used. Some of the respiration experiments mentioned by Professor Zuntz are of a different nature from those of Pettenkofer and Voit which have been described at length in publications of this Office. In Professor Zuntz's experiments a sort of mask was worn over the mouth and nose, or a connection made with the bronchial tubes. Air enters through one tube, passes through the lungs, and is excreted or respired through a second tube. An arrangement of valves provides that the air shall always be inspired and respired through the respective tubes. The amounts of oxygen consumed and carbon dioxid produced are the factors measured, and the relation of carbon dioxid to oxygen gives the respiratory quotient. The determination of the respiratory quotient under different conditions of food and labor promises to be of great assistance in studying the metabolism of the nutrients and determining their functions under given conditions. Experiments of this nature have also been made in Pflüger's laboratory, and in Paris by Hanriot and Richet and by other investigators.

In regard to the formation of fat from the protein of the food, it will be remembered that Professor Pflüger has for a long time bitterly

opposed Voit's theory that fat could be formed from protein. As Professor Zuntz states, this theory was based on experiments made with dogs fed upon meat which was assumed to be practically free from fat or glycogen. Voit believed that meat prepared as he prepared it had a uniform composition, but this assumption has been found not to be strictly true. The nitrogen in the meat was not determined but calculated, and this has been a point much criticised. From a careful revision of Voit's figures and Pflüger's criticisms of them it would seem that in only one case was the food sufficient to permit a storing up of any reserve material. In this particular case, granting Pflüger's objection to Voit's mean value for the meat fed, and substituting the corrected value he suggests, the dog did not excrete all the carbon consumed in the protein of the food, but stored up an appreciable amount as fat.

Perhaps all that can be said now is that the question is still an open one. Voit's work is not conclusive, but on the other hand it is not invalidated by Pflüger's criticism. As Professor Zuntz points out, the evidence would seem to prove the formation of carbohydrates from protein, and furthermore that fat may be formed from carbohydrates. Hence, "the formation of fat from protein must also be admitted."

Professor Zuntz discusses at considerable length the amount of energy of the food consumed which is available for muscular work. He gives as his opinion that for all mammals the value is practically constant, representing about 35 per cent of the total energy of the food. A much higher value is quoted from Wolff and Kreuzhage's experiments with horses. In the current number of the Record an abstract is given of further experiments by Wolff and Kreuzhage with horses, from which it will be seen that the value for the mechanical equivalent of food which Professor Zuntz criticises has been considerably changed and does not now differ materially from what he considers correct. The animal organism considered as a machine is much more economical than any other kind of prime motor.

One of the most interesting considerations brought out by Professor Zuntz is that the character of the nutrients metabolized is influenced by the kind of work performed. This differs from opinions which have been generally held. Pflüger has insisted that, provided protein was present, it was the sole source of muscular energy. Others have maintained that carbohydrates were the principal source of energy. Pflüger based his opinion in part on some experiments which were made by Argutinsky. The work done was carefully measured and it was believed that the nitrogen excretion showed the metabolism of sufficient protein to account for all the energy produced. Some interesting experiments were made by Paton in Edinburgh which show that Pflüger's conclusion was not justified. When work was performed the metabolism of the protein was increased, but the energy furnished by this increased metabolism of the protein was sufficient to account for only 35 per cent of the work actually performed. Accord-

ing to Paton, Argutinsky left out of account the motion of forward progression, which demands considerable energy.

The opinion has been generally held that either protein, fat, or carbohydrates could yield energy, and that, provided a comparatively small amount of protein was supplied, which served to repair the waste tissue of the organism, it was unessential which of the nutrients was present, provided only that the necessary number of calories was furnished.

According to Professor Zuntz, intense muscular energy must be derived from the combustion of protein. Such muscular exertion can not be continued for a long time, though this factor would be influenced probably by the personal characteristics of the subject. A greater amount of work performed in a much more leisurely way may be provided for by the combustion of nitrogen free nutrients. This perhaps explains why many of the poorer classes in Europe exist in comparative comfort on a diet which according to American ideas is deficient in protein. The character and not the amount of work determines the sort of nutrients necessary. This theory certainly harmonizes with observed facts better than any other.

THE METABOLISM OF NUTRIENTS IN THE ANIMAL BODY AND THE SOURCE OF MUSCULAR ENERGY.

Prof. N. Zuntz,
Royal Agricultural High School, Berlin.

A scientific treatise on nutrition must have for a foundation the clearest possible explanation of the changes which the nutrients undergo in the organism and the function for which each is fitted. Scientists disagree upon this question, and especially upon the way in which muscular force is produced.

Liebig recognized that the muscles (which are the agents in producing muscular force) are composed chiefly of protein and that they can perform their functions for a long time without the addition of new material. From this he concluded that protein must be the source of muscular power—that is, that the muscles produce mechanical force because they are broken up into their component parts and oxidized.

Speck and Voit disputed this theory when it was found that the excretion of nitrogen in the urine was only slightly modified by the amount of muscular labor performed, and that there was no simple relation between muscular exertion and the urinary excretion of nitrogen. But Voit still maintained the idea that the metabolism of protein was the important factor in the production of energy, and in proof of this advanced the theory that whether the organism was at rest or performing labor the same amount of protein was metabolized. If mechanical labor is produced the protein is utilized for this; at other times it simply produces heat. He and Pettenkofer compared the metabolism of protein in the animal body to a mill stream; it produces mechanical labor when it flows over the water wheel, and at other times the energy is not utilized.

Even with these modifications Liebig's theory can not be accepted. The maximum energy which the metabolism of protein in the body can yield has been determined by Rubner[1] by means of exact calorimetric investigations. Very recently these estimates have been revised by Pflüger,[2] and only comparatively unimportant changes made. On the basis of these results it may be assumed that the metabolism of 1 gm. of nitrogen in the animal body produces 26 units of heat, the equivalent of 11,050 kilogrammeters of mechanical force.

[1] Ztschr. Biol., 21, pp. 250, 333.

[2] Pflüger's Arch. Physiol., 52, p. 43.

Kellner and E. Wolff[1] have made a large number of experiments with a draft horse. For a long time the same amount of work was performed daily, and the actual mechanical equivalent of this and the nitrogen excreted in the urine were determined. Assuming that only the protein can serve for the production of external muscular labor, in many of these experiments scarcely half of the work actually done can be accounted for. For example, in one experiment the horse consumed for a week a ration of 6 kg. of meadow hay, 6 kg. of oats, and 1.5 kg. of starch, and every day made 600 revolutions with a circular dynamometer, producing 2,154,000 kilogrammeters of work. The daily excretion of nitrogen in the urine was 108 gm. The formation of this amount of nitrogen from protein by cleavage could have yielded, at most. 2,808 heat units—i. e., 1,193,000 kilogrammeters—which is scarcely half of the work actually performed. The discrepancy is still more apparent when it is remembered that the beating of the heart and breathing represent a considerable amount of mechanical labor, which increases with increased external work, and on an average can be scarcely less than 10 per cent of this.

There can be no doubt that the nitrogen-free constituents of the body are also concerned in the production of mechanical force. Some investigators go still further, and conclude that only the latter, and more particularly the *carbohydrates*, are to be looked upon as the source of muscular energy. They liken the muscles, composed of protein, to the metal of an engine, and the nitrogen-free materials of the food to the coal. The coal burned on the grate is the source of the energy, and not the materials composing the machine.

But this opinion is erroneous, for muscular energy can be produced by the metabolism of protein only. This has been recently shown by Pflüger[2] in an experiment with a very lean dog fed for many months on the leanest meat and required to perform considerable labor, which consisted in drawing a cart. The experiment showed that protein alone can satisfy all the functions of the animal body, and, provided the stomach can digest a sufficient quantity of it, an animal can live on protein alone. As is well known, this is true of no other nutrient.

In this respect at least protein deserves its name, i. e., the "first or principal nutrient."

In support of the view that the nitrogen-free nutrients, more especially the carbohydrates, are the source of muscular energy, it has been suggested that the protein molecules undergo such cleavage in the animal organism that nitrogen-free substances are produced, and that these are the real source of muscular energy. This view is not regarded as very probable, although there is considerable evidence in its favor. Thus, Voit advanced the opinion that fat is formed from protein when it is supplied in excess. Many experiments were made which seemed to

[1] Jahresber. agr. Chem., 30, p. 564.
[2] Pflüger's Arch. Physiol., 50, p. 98.

prove this theory. Among the more important are Pettenkofer and Voit's[1] long series of respiration experiments with dogs fed only on meat which was considered to be free from fat. The conclusion was reached that part of the carbon consumed in the protein of the meat remained in the organism, while all the nitrogen was excreted in the urine and feces. If carbon is retained day after day in the organism it must be in the form of fat, as it is the only carbon compound free from nitrogen which can be stored up in the body in any considerable quantity. These experiments have been almost universally accepted as furnishing proof of the formation of fat from protein. Recently Pflüger[2] has gone over this work very carefully, recalculating the results, and has pointed out that the carbon content of the meat used in the calculations was too high and the fat content too low. He claims it is possible to derive all the fat which was stored up in the organism from fat consumed in the food.

In some of their experiments Pettenkofer and Voit fed carbohydrates in addition to meat. Pflüger grants that in such cases there is no doubt that fat was formed, but he considers it an error to assume, as Pettenkofer and Voit did, that this fat was formed from the protein. They did not believe that fat could be formed from carbohydrates; but the possibility of this has been repeatedly demonstrated by experiments since made, among others those of Meissl with swine.[3]

Pflüger claims, as a result of his recalculation, that in many cases the results of Pettenkofer and Voit's experiments indicate the formation of fat from carbohydrates.

Thus, opinions to-day are diametrically opposite to those entertained a short time ago. The formation of fat from carbohydrates, which was so long disputed, must be accepted as a well proven fact; while the proofs of the formation of fat from protein are very much weakened.

It would seem, therefore, well worth while to carefully consider the facts which indicate a cleavage of the protein molecule into molecules containing no nitrogen. In severe cases of diabetes considerable quantities of sugar are excreted in the urine, even if the diet contains no carbohydrates. The sugar must be formed either from protein or from fat. It has been shown that the quantity of sugar excreted increases with increased consumption of protein, but is not affected by the amount of fat consumed. This indicates a formation of sugar from protein.

It was found a few years ago by von Mering[4] that doses of phlorhizin will induce an excretion of sugar in the urine at any time with no other disturbance of the healthy functions of the body.

The urine of dogs given about 1 gm. of phlorhizin per kilo of their weight contains 10 to 15 per cent of sugar; and there is an intimate

[1] Ztschr. Biol., 7, p. 410, 9, p. 110.

[2] Pflüger's Arch. Physiol., 51, p. 228.

[3] Ztschr. Biol., 22, p. 84.

[4] Verhandl. 5 Cong. f. innere Med., 1886, p. 185; Verhandl. 6 Cong. f. innere Med., 1887, p. 349.

connection between the excretion of sugar and the consumption of protein. If given to a fasting animal the excretion of nitrogenous substances in the urine increases directly with the sugar excretion. This would warrant the conclusion that both are derived from the same source, namely, protein. But the proof is still stronger. When a sufficient quantity of phlorhizin is given to a fasting animal the organism becomes very deficient in carbohydrates. If the animal continues to fast and to receive phlorhizin large quantities of sugar are still found in the urine, quantities which parallel investigations have shown to be many times greater than the total amount of carbohydrates contained in the tissues of the organism. The many investigations which have been made in recent years on the source of the glycogen of the body also furnish proof of the formation of carbohydrates from protein. Külz[1] has made some of the most careful of these experiments. Glycogen, as is well known, is a carbohydrate closely related to starch. In normally nourished animals it constitutes several per cent of the total weight of the liver and 0.3 to 1 per cent of the weight of muscles. Glycogen disappears after continued fasting, and, as Külz has shown, more rapidly from the liver than from the muscles. It is possible to hasten the disappearance of glycogen (1) by giving an animal phlorhizin and thus removing sugar, and (2) by the performance of muscular labor. The importance of the latter method may be seen from the following experiment. Külz found that one and a half days after the last food was consumed the liver of a well nourished dog was nearly glycogen free, provided that the animal had performed muscular labor for 57 hours. If no work was done the fasting must be continued for 3 or 4 weeks to obtain the same result. Külz has also shown that glycogen is produced when animals which have fasted for a long time are given a diet of pure protein.

It would seem that glycogen can be formed and stored up by fasting animals from the protein of the organism. The necessary condition is that the least possible muscular labor be performed. Nebelthau,[1] a pupil of Külz, observed the formation of glycogen by fasting animals under the influence of a number of narcotics, for instance, chloralhydrate, paraldehyde, sulfonal, chloroform, ether, and alcohol.[2] The formation was particularly noteworthy in the case of chloralhydrate. This unites in the organism with glycuronic acid (a body very nearly related to the sugars) and forms urochloralic acid,[4] which is excreted in the urine. Thus a considerable quantity of carbohydrates is removed from the organism.[5] All this evidence would seem to prove the formation of carbohydrates from protein.

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[1] Festschrift f. C. Ludwig, Marburg, 1890, p. 69. Pflüger's Arch. Physiol., 24, p. 70, etc.

[2] Halliburton, Text-book of Chem. Physiol. and Pathol., p. 110.

[3] Halliburton, Text-book of Chem. Physiol. and Pathol., p. 793.

[4] Jaffe, Ztschr. physiol. Chem., 2, p. 47.

[5] Külz, Ztschr. Biol., 27, p. 247.

Since the formation of fat from carbohydrates in the body is also proven, the possibility of the formation of fat from protein must also be admitted, although the experiments which were formerly considered proofs of it have been weakened by Pflüger's criticism.

Many statements have been made above which indicate that carbohydrates can yield muscular energy. For instance, when a dog performed muscular labor for a few hours almost all the glycogen was removed from the organism. According to Külz the surest method of eliminating glycogen from the body is to so poison the animal with strychnine that convulsions of several hours' duration are produced.

The consumption of glycogen in muscular exertion is also proved by direct experiment. If muscular contractions are produced as long as possible by passing an electric current through the muscles of the legs of a frog which has just been killed, less glycogen will be formed than where no muscular contractions are produced. The same experiment can be performed with the muscles of warm-blooded animals.

The corollary to this experiment consists in paralyzing the muscles of one of the hind legs of an animal by severing the nerves. After a few days, investigation shows that the muscles of the injured leg contain more glycogen than those of the uninjured leg.

If the muscles always consume glycogen when work is done the continual drain must be made good in some way. The source which is drawn upon for this purpose appears to be the sugar of the blood. It is remarkable that under all conditions of nourishment the blood contains a small but constant amount of sugar, about 0.15 per cent. The venous blood which leaves the muscles always contains a little less sugar than the arterial blood which enters them. This difference is greater when the muscles perform work, notwithstanding the fact that three times as much blood passes through them.[1] If the blood always contains the same percentage of sugar in spite of the fact that some is continually being removed from it by the muscles, sugar must be constantly supplied from some source. It is generally considered that this is the glycogen which is stored up in the liver; the supply in the liver being kept up by the sugar consumed in the food. If no carbohydrates are consumed it is formed from protein.

From what has been said it will be seen that muscular energy can be produced by protein alone, but, on the other hand, that carbohydrates in the form of glycogen and blood sugar are concerned in its production.

Whether fat, as such, can also be utilized by the muscles for the production of energy is not known with certainty. It seems probable, however, that such is the case, since an animal will live and perform work on a diet which contains much fat and very little protein. Accurate measurements of the amount of work possible under such conditions are at present not available, therefore the opinion that in these cases the energy is really produced only from protein can not be accepted as final.

[1] Chauveau and Kauffmann, Compt. rend., 104, pp. 1126, 1352, 1763.

Up to the present only the *kind* of material which is utilized in the performance of muscular exertion has been considered. Facts concerning the quantitative relations which exist have been obtained by two methods, one elaborated by Kellner and E. Wolff, and the other dating back to Lavoisier for its conception, and first employed by E. Smith for systematic measurements in experiments with man.

Kellner and Wolff[1] proceed as follows: A horse is made to perform the same amount of work day after day, and at the same time the food is so regulated that the weight of the animal remains unchanged. The animal must then be in nitrogen equilibrium; that is, the nitrogen in the urine is practically equal to the amount absorbed from the food. If the work is increased the animal begins to lose weight and the excretion of nitrogen in the urine increases. This shows that some of the protein of the organism is being metabolized. The amount of food is then increased until equilibrium is again reached and maintained. If this additional food consists at one time of protein and at another of fat or carbohydrates, it is possible to determine how much of each nutrient is required to perform a definite amount of work. The results obtained by this method are not very exact, for many weeks are necessary for each experiment, and during this time certain conditions which effect metabolism—for instance, temperature—may also change.

According to Kellner and Wolff, about 30 per cent of the mechanical equivalent of starch and fat, as shown by the heat of combustion, is utilized by the animal in the production of muscular labor.

The second class of investigations on the metabolism of energy is based upon respiration experiments. The increased metabolism of matter which is necessitated by muscular exertion increases the consumption of oxygen and the excretion of carbon dioxid. A study of the gas exchange, therefore, should give much more accurate results than a comparison of the amounts of food consumed and excreted, since neither carbon dioxid nor oxygen can be stored up in the organism in any considerable quantity. An animal may be deprived of nourishment for several days without much disturbance of the bodily functions; but if the supply of oxygen is cut off for 5 minutes the animal dies. Hindering the excretion of carbon dioxid for any considerable time is also disastrous. Furthermore, respiration increases almost immediately when muscular work is begun and diminishes as quickly when the work ceases. Five minutes after muscular exertion has ceased, although it may have been long and severe enough to increase the respiration sixfold, a healthy animal consumes the same amount of oxygen and excretes the same amount of carbon dioxid as during absolute rest.

The study of the gas balance therefore furnishes a convenient and accurate method of studying the increased consumption of material which is demanded by muscular exertion. The ratio to each other of the oxygen consumed and the carbon dioxid excreted gives the so-called respiratory quotient. This may furnish valuable information

[1] Landw. Vers. Stat., 21, p. 19.

concerning the nature of the materials which undergo metabolism in the organism.

Regnault and Reiset[1] have shown in their classic "*Reserches sur la respiration*" that provided the time of the experiment is long the character of the food is practically the only thing which influences the respiratory quotient. In other words, the respiratory quotient is the ratio of the oxygen necessary for the combustion of the food to the carbon dioxid produced.

In the combustion of carbohydrates the amount of oxygen consumed is just equal to the quantity of carbon dioxid produced. The quotient is therefore 1. In the combustion of animal and vegetable fats it is about 0.7, and of protein about 0.8. This last figure does not represent the complete combustion which is obtained, for instance, in an elementary analysis, but the combustion which actually takes place in the animal body, in this case an intermediate product (urea) is formed and excreted in the urine.

The experiments of Lehmann and Zuntz[2] have shown that the respiratory quotient of a normally nourished horse doing no work is 0.95. This indicates that principally carbohydrates are oxidized. When work is done the result is very little affected, usually being lowered a few units in the second decimal place. This shows that the increased oxidation produced by muscular work increases the metabolism of protein, fat, or both, a very little more than that of the carbohydrates. If the metabolism of carbohydrates was increased, the respiratory quotient would become nearer 1. This disposes of the theory that carbohydrates are the only source of muscular energy.

When no work is done and the respiratory quotient is low (0.7 to 0.75), it is probable that fat is the principal substance which is metabolized. Such a respiratory quotient is never found in experiments with horses, but has been observed by Zuntz and Katzenstein[3] in many experiments with man and dogs, either fasting or on a diet of meat and fat. In this case, if work was done the respiratory quotient became greater. This shows that the relative amount of carbohydrates or protein metabolized has increased.

When the nutrients are metabolized in such a ratio that the respiratory quotient has a mean value of about 0.8, it remains unchanged when work is done. This would seem to indicate that the relative quantity of nutrients metabolized had remained unchanged, or it might also indicate that the amount of protein had changed, for if protein alone was metabolized the quotient would still be 0.8. In this case, therefore, no definite conclusion could be drawn.

The question of the most suitable proportions in which to combine the nutrients in order that the greatest amount of muscular labor may

[1] Ann. Chim. et Phys., ser. 3, 26, p. 462.

[2] Landw. Jahrb., 1891, p. 143.

[3] Pflüger's Arch. Physiol., 49, p. 365.

be produced will be referred to again. It is desirable first to consider briefly the quantitative relations which exist between the consumption of nutrients and the production of work.

In the work which a horse ordinarily performs the total muscular energy may be separated into two factors. One, which may be directly measured, represents the amount of energy expended in drawing or raising a load. The other represents the amount of internal muscular energy which is employed in forward progression, and is not available for external work. That this last factor may represent a considerable portion of the total energy may be deduced from Kellner's experiments.[1] By the methods employed in problems in mechanics he endeavored to resolve the total force expended in locomotion into its component parts. Deductions of this sort, however, can not yield very accurate results.

In a recent publication E. Wolff has employed another method in computing the energy of forward progression of an animal doing no work. According to his calculations it is equal to one half the product obtained by multiplying the weight of the animal by the square of the velocity attained. This presupposes the fact that the total vital force employed in motion is produced anew at each step, and further that the velocity attained at each step is all expended in overcoming the resistance to motion offered by the surface passed over.

This supposition may perhaps hold good for walking, but for trotting and galloping it is certainly incorrect, since it is not possible to instantly arrest such rapid motion. As a matter of fact Wolff admits that his results for animals in rapid motion are too high.

Lehmann and Zuntz[2] computed the energy expended in locomotion from the amount of oxygen consumed. They determined (1) the amount of oxygen consumed per minute by a horse doing no work, (2) the amount consumed for locomotion when no load was drawn, and (3) the amount consumed when the same speed was maintained and a known load was drawn. In some of the experiments the horse traveled up an incline instead of drawing a load. In this case the amount of work done each moment can be determined by multiplying the altitude of the incline by the weight of the animal.

The increased consumption of oxygen when work was combined with locomotion shows how much was really required for the amount of work done. From this the amount of oxygen per kilogrammeter of work can be calculated. The amount of oxygen varied a little with the character of the work. It was also somewhat different for different individuals. For instance, in the case of a rather light East Prussian horse poor in flesh the oxygen consumption per kilogrammeter of work performed in climbing an incline was found to be 1.32 to 1.34 cc., and a slightly larger quantity, 1.35 to 1.37 cc., for the work of drawing a load. In the case of another horse of more compact build and less active disposition the somewhat

[1] Landw. Jahrb., 8-13 and 16, Sup. 3.
[2] Landw. Jahrb., 1894, p. 143.

higher result, 1.52 cc. per kilogrammeter, was obtained. In the case of the first animal the oxygen consumption per kilo live weight was 0.81 cc. for the motion of forward progression when no other work was done. In the case of the second animal the amount was only 0.68 cc. The curious fact is noticeable that the horse which required more oxygen for the performance of external work required less for forward progression. As would be expected under these conditions, each animal required about the same amount for the performance of moderate labor, equal to about 75 kilogrammeters per second. For more rapid motion over the same distance the oxygen consumption was increased. The first horse required about 27 per cent more oxygen when trotting than when walking, and the second about 60 per cent more. This large difference between the two horses is not surprising, since horses trot very differently. The second horse at each step threw the center of gravity forward much more than the first. He was a so-called "high-stepper."

By comparing the amount of oxygen required for forward progression with that which is necessary to produce 1 kilogrammeter of external work the amount of energy expended can be determined. The horse which required 0.68 cc. of oxygen per meter for forward progression required 1.52 cc. per kilogrammeter of external muscular work. Forward progression required per meter, therefore, $\frac{0.68}{1.52}$, or 0.45 kilogrammeter of energy. The forward progression of a horse weighing 500 kg. would therefore be equal to 22.4 kilogrammeters for each meter traveled.

From the composition of the food consumed the amount metabolized per liter of oxygen consumed can be calculated with the aid of the following data:

Oxidation of 1 gm. muscular tissue requires 1.336 gm. oxygen and produces 4.047 calories.

Oxidation of 1 gm. animal fat requires 2.916 gm. oxygen and produces 9.423 calories.

Oxidation of 1 gm. grape sugar requires 1.067 gm. oxygen and produces 3.692 calories.

Oxidation of 1 gm. starch requires 1.185 gm. oxygen and produces 4.123 calories.

Since one calorie is the equivalent of 425 kilogrammeters, the mechanical equivalent of the heat produced can be easily computed.

In Zuntz and Lehmann's experiments, if the calculations are based on the composition of the food, the consumption of 1 liter of oxygen should yield 2,135 kilogrammeters of energy. The 1.36 cc. of oxygen which one of the horses actually required for the production of 1 kilogrammeter of external muscular work would be sufficient theoretically to produce 2.893 kilogrammeters. The food consumed is utilized for the production of external muscular energy in the ratio of 1 : 2.893, that is, 34.6 per cent. This value seems to be very nearly constant for all mammals.

Under the direction of Zuntz, Katzenstein[1] investigated the oxygen consumption of man when walking on a level or up an incline. It was

[1] Pflüger's Arch. Physiol., 49, p. 365.

found that 1 kilogrammeter of mechanical force when expended in climbing required 1.19 to 1.50 cc. of oxygen, and motion of forward progression required 0.11 cc. of oxygen per kilo of weight of the individual for every meter traveled. In the performance of other kinds of labor man does not utilize the energy of the nutrients quite so well. In turning a lathe 1 kilogrammeter of work required 1.96 cc. of oxygen.

The food which required 1.435 cc. of oxygen to produce 1 kilogrammeter of energy expended in walking should produce theoretically 2.84 kilogrammeters. In other words, about 35 per cent of the total energy of the food is available for external muscular labor. This is about the same quantity obtained in the experiments with horses. In a small number of experiments made with dogs practically the same value was obtained. Therefore, the conclusion is drawn that this value holds good for all warm-blooded animals. Comparison shows that the animal organism utilizes the energy of food for the production of external muscular work much more thoroughly than an engine utilizes the energy of fuel. A steam engine ordinarily transforms only about 5 per cent of the energy represented by the fuel value of the coal into mechanical power, although some very carefully constructed engines furnish 15 per cent of the energy of the fuel. The animal organism utilizes about seven times as much of the energy of the food.

As was pointed out above, Kellner and Wolff calculated that the utilization of the energy of the nutrients was even better, but considering the uncertainty of the methods employed their figures can hardly be accepted in place of those just quoted.[1]

Using the units which have been given, it is a simple matter to calculate how much material is actually metabolized when an animal travels a given distance or performs mechanical labor—provided the amount of work done in each case can be estimated with reasonable accuracy. It must be said that even when an animal performs no external muscular labor, nutrients must still be metabolized for the production of energy. This energy is required for the beating of the heart, the muscular movements of respiration, and in much greater degree for the processes of digestion. Accurate measurements have been made of the energy expended in digesting food. The increase in the consumption of oxygen when food is chewed has also been determined and found to be equal to 51 to 59 per cent of the amount consumed when no work is done.

It is well known that it takes a horse much longer to chew 1 kg. of coarse fodder than the same amount of grain. It has been found that the oxygen consumption increases 11.4 liters for the labor of chewing 1 kg. of oats, 7.7 liters for 1 kg. of corn, and 33.7 liters for 1 kg. of hay. From these figures the quantity of nutrients which must be metabolized to carry on the work of chewing can be calculated. For oats it is

[1] See new work in Landw. Jahrb., 24 (1895), No. 1–2, pp. 125–271, and abstracted on p. 610 this number of the Record.

found to be 2.8 per cent of the total quantity assimilated, for corn 1.4 per cent, and for hay 11.2 per cent. Closely connected with the labor of chewing and swallowing is that expended in the muscular movements of the stomach and intestines and in the secretion of digestive juices by the various glands. The amount of this work as well as the material necessary to maintain it may in a way be estimated by comparing the increased consumption of oxygen during the few hours immediately following the consumption of food with that observed during hunger. It might be thought that this increase was due to the presence of the nutrients taken into the circulation; that is, that the nutritive materials used were increased with the amount supplied, as in the case of the fuel placed in a stove; but this comparison is not apt. The amount of oxidation in the organism is influenced solely by the amount required for performing labor or producing heat, and not at all by the amount of nutrients which may be present. This has been shown by von Mering and Zuntz.[1] They introduced solutions of nutrients in considerable quantity directly into the blood of animals and found that the consumption of oxygen was not at all increased. The extra nutrients were stored up by the animal as reserve material. Therefore the increased oxygen consumption immediately after eating can only be produced by the labor of digestion.

In feeding with a normal mixture of oats and hay the increased oxygen consumption is 10.7 per cent, and when hay only is fed, the amount being just sufficient to maintain the animal and permit a very little work to be done, it is 19.8 per cent in excess of the amount of oxygen consumed when fasting. In this case also it may be seen that the bulky hay requires more energy for its digestion than the more concentrated food.

It is evident that the unequal "ease of digestion" materially changes the nutritive value of feeding stuffs from the values which are derived simply from their chemical composition. The nutrients which are assimilated from coarse fodder yield the organism about 20 per cent less available energy than the same amount assimilated from grain, since the coarse fodder requires so much more energy for its digestion.

Respiration experiments furnish accurate information concerning the quantity of nutrients which is required for the performance of various kinds of work. They show more clearly than any previous method how much of the energy of the assimilated nutrients is available for the organism after the labor of digestion is accomplished. They give no information, however, as to what combination of nutrients is best suited for the production of the greatest possible amount of muscular energy.

The general practice of feeding work animals a ration rich in protein is in harmony with Pflüger's observations. The dog which he fed for months on meat only was able to perform severe muscular labor. Often,

[1] Pflüger's Arch. Physiol., 32, p. 173.

however, even dogs could not digest a sufficient amount of protein. On a diet of protein the digestive juices which are adapted for the assimilation of fat and carbohydrates are not utilized. When it is desired to feed an animal a ration which will give the maximum amount of work, a combination of nutrients must be selected which will utilize all the energy available for digestion. Care must be taken also not to feed too much coarse fodder, since it has been seen that such food materially increases the labor of digestion. On the other hand, coarse fodder must not be omitted altogether. Grandeau and Leclerc[1] have shown that disturbances of the digestive organs are produced when horses are fed entirely on grain. At all events, grain should form the greater part of the ration of horses which perform severe work. The question as to whether oats or beans are to be preferred to maize, which contains more nutrients in a given quantity, but less protein, would seem to depend entirely upon the kind of work to be done. Kellner and Wolff[2] found that the slow but long-continued labor of drawing a load was endured with no bad after effects when the food consisted entirely of carbohydrates or fat.

Thus it would seem that there is no peculiar value in food material very rich in protein. The principal requirement seems to be to supply an abundance of food which can be easily digested. The case is different when the animal must perform intense muscular labor for a short time, as in the case of saddle or driving horses traveling rapidly. Here various conditions unite to render a large supply of protein necessary. With such animals it is often the case that the respiration does not keep pace with the enormously increased demand for oxygen. As soon as there is a deficiency of oxygen in the tissues there is an increased metabolism of protein.

Oppenheim[3] has shown by experiments, in which he was himself the subject, that whenever muscular exertion is increased until breathing becomes labored the metabolism of protein is also increased. A greater supply of protein should therefore be provided in such cases. An abundance of protein is useful in other ways in the production of intense muscular energy. It is known that when muscular labor is performed organic acids—sarcolactic acid, for instance—are produced. If these acids accumulate in the blood the ability to perform work is diminished. Lactic acid produces weariness. Its presence lessens the productive power of the muscles. The acid produced by the muscles in activity and carried into the blood is in part oxidized and in part neutralized by ammonia which is formed from protein. It is natural to suppose that the marked diminution in the alkaline character of the blood would not occur as readily as it does when the diet is rich in protein. This question has recently been carefully investigated by

[1] Etudes experimentales sur l'alimentation du cheval de trait, 1883, 18-7, and 1889.
[2] Landw. Vers. Stat., 11, Sup. III.
[3] Pflüger's Arch. Physiol., 23, p. 446.

Cohnstein.[1] As was the case in earlier observations, he found that with herbivora (rabbits) muscular labor caused a much greater diminution of the alkaline character of the blood than with carnivora (dogs). With the latter the diminution was less for the same amount of work in proportion to the richness of the diet in protein.

These investigations also show that much protein is required if a great amount of work must be done in a short time; and further, when more severe work must be performed, but in a more moderate manner, even though the total amount per day be greater, it is not necessary that the quantity of protein in the food be very large.

The same conclusions hold good for man. Laborers who perform a great amount of work per day, but at no time of a very intense character, are well nourished on a diet which is not very rich in protein, provided the diet be abundant and easily digested. As an example may be cited the Chinese and Japanese laborers, whose diet consists principally of rice. On the other hand, athletes who endeavor to perform for a short time the greatest possible amount of muscular labor, as in running, rowing, or similar exercise, always select a diet rich in protein.

The fact that factory operatives, who work steadily and show much endurance, can perform a greater amount of work on a diet rich in animal food than on bread, potatoes, and the like, is not wholly or perhaps principally explained by the fact that the animal food contains more protein. It is probable that here also the same reason holds good as in the case of coarse fodder and grain. Vegetable food provides the human organism a large amount of "ballast" which can be digested only with difficulty, or not at all. When the work of digestion is increased the amount of energy available for external muscular labor is diminished. In addition to this the digestive organs, when such demands are made upon them, require a greater supply of blood, therefore the amount which can circulate through the muscles is diminished.

[1] Virchow's Arch. path. Anat. und Physiol., 130 (1892), p. 332.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

On ammonium-manganese phosphate and its use in the volumetric determination of phosphoric acid, LINDEMAN and MOTTEU (*Bul. Chem. Soc. Paris, 13–14 (1895), No. 10, pp. 523–533*).—The principle of the method proposed consists in separating the phosphoric acid in the form of ammonium manganese phosphate, oxidizing the manganese and determining its amount by the iodometric method. From the figures thus obtained and the known composition of the ammonium-manganese phosphate the phosphoric acid is calculated.

The method is conducted as follows: To 50 cc. of a solution of the phosphate containing about 100 mg. of phosphoric acid add 10 cc. of a 20 per cent solution of ammonium chlorid, 10 cc. of ammonia, 20 cc. of a solution of citrate of ammonia containing 150 gm. of citric acid and 500 cc. of ammonia in 1 liter of water, and 25 cc. of a $2\frac{1}{2}$ per cent solution of crystallized sulphate of manganese. Then boil the solution for 5 minutes, and after cooling, filter and wash rapidly the beaker and precipitate with 100 cc. of a 0.5 per cent solution of ammonium chlorid.

If it is desired the precipitate obtained may be dissolved and phosphoric acid determined by the ordinary molybdic method. Otherwise, dissolve the precipitate in dilute hydrochloric acid and collect the solution in the beaker in which the precipitation was made. Dilute the filtrate with 250 to 300 cc. of water, add 1 to 4 cc. of peroxid of hydrogen, followed by 20 cc. of a 10 per cent potassium hydrate, and boil the whole for 10 minutes to expel excess of peroxid. After cooling, add 20 cc. of 20 per cent hydrochloric acid and allow to stand for a few minutes in order to destroy the alkaline peroxid, add 20 cc. of a 10 per cent solution of iodid of potash, and titrate immediately with sodium hyposulphite.

The principal error in this method appears to be a constant one, due to solubility of the ammonium-manganese phosphate. Experiments indicate that the results by this method should be increased by 4 mg. In a large number of determinations of phosphoric acid in sodium phosphate the results by this method agreed fairly well with the theoretical percentages, and in case of natural phosphates with the amounts shown by the ordinary method, although they were slightly lower, especially with the natural phosphate.

The determination of phosphoric acid by the molybdate method, H. NEUBAUER (*Ztschr. anorgan. Chem., 10 (1895), No. 1, pp. 60–65*).—The article is mainly a study of the loss of phosphoric acid from volatilization on the ignition of magnesium pyrophosphate. The author claims that the results should be corrected by the following formula:

$$X = (n - 70)\ 0.021,$$

in which n denotes the weight in milligrams of magnesium pyrophosphate found.

Correction is especially recommended for weights of magnesium pyrophosphate greater than 0.27 gm. unless precautions are taken to actually collect and weigh the phosphoric acid volatilized. For quantities of magnesium pyrophosphate less than 0.07 gm. no correction need be applied.

The author does not deem the use of the Gooch crucible advisable for collecting and igniting the ammonium-magnesium phosphate. He calls attention to the slowness of precipitation by the ordinary magnesia mixture with stirring, the necessity of 1 hour's ignition of the precipitate at a full glow, and the danger from the absorption of sulphur by the magnesia on the crucible lid when gas is used. Alcohol burners are recommended instead of gas lamps.—C. L. PARSONS.

On the decomposition of silicates by means of boric acid, P. JANNASCH (*Ber. deut. chem. Ges., 28 (1895), No. 17, p. 2822*).—One gram of the finely-powdered silicate is mixed with 5 or 6 gm. anhydrous boric acid and intensely heated 15 or 20 minutes. The fused mass will be found almost entirely soluble in hot water and alcohol. This solution is evaporated repeatedly with addition of hydrochloric acid and methyl alcohol to expel the boric acid. and the analysis finished in the usual way.—A. M. PETER.

The determination of nitric nitrogen in the presence of organic nitrogen, T. PFEIFFER and H. THURMANN (*Landw. Vers. Stat., 46 (1895), No. 1, pp. 1–20*).—The methods of determining nitric nitrogen in the presence of organic nitrogen were studied with especial reference to urine and liquid manure. The following method was worked out and is recommended as best adapted for the purpose: Fifty cubic centimeters of the liquid to be examined is heated with 10 gm. of sodium hydrate in a Lintner pressure flask at 120 to 130° C. for about 8 hours. When cold the contents are filtered and the precipitate washed and dried. The filtrate is diluted with water in a distilling flask, boiled until the ammonia has been expelled, the precipitate added, the filter washed with acetic acid and water, and the reduction conducted with zinc-iron in the ordinary manner. Care must be exercised in distilling to avoid frothing. Following this method 99.7 to 101.2 per cent weighed quantities of nitric nitrogen were recovered in 4 trials.

The addition of peat litter of known composition is recommended in

the sampling and analysis of farmyard manure, night soil, etc.—F. W. WOLL.

Examination of nitrogenous organic bases of seeds, oil cakes, and tubers, E. SCHULZE (*Landw. Vers. Stat.*, *46* (*1895*), *No. 1*, *pp. 27–35*).—The author describes 3 different methods adopted by himself and assistants for the determination of nitrogenous organic bases (cholin, betain, trigonellin, stachydrin, arginin, guanidin) in seeds, oil cakes, tubers, and plants of agricultural importance.—F. W. WOLL.

Contributions to Kühn's method of artificial digestion of nitrogenous food stuffs by pepsin solution, A. KOHLER, F. BARNSTEIN, and W. ZIELSTORFF (*Landw. Vers. Stat.*, *46* (*1895*), *No. 23*, *pp. 193–200*).—According to the results given in the paper, hydrochloric acid may be added to the pepsin solution in 2 portions without influencing the solubility of the nitrogenous components, and the treatment with ether previous to the digestion is not strictly necessary. In the case of 8 different fodders the results were higher in amount of nitrogen remaining undissolved where no previous extraction had been made, the differences being, however in the opinion of the authors, without significance.—F. W. WOLL.

Quantitative estimation of cellulose, G. LANGE (*Ztschr. angew. Chem.*, *1895*, *No. 19*, *pp. 561–563*).—The author's method published in 1889[1] has been but little modified, and is as follows: From 5 to 10 gm. of the substance is placed in a large, wide, porcelain crucible, moistened with water, a threefold weight of potassium hydrate free from nitrate added, and the whole covered with 20 cc. of water. The crucible is then placed in an oil bath, taking care that the level of the liquid within the crucible is the same as that without. The temperature of the bath must be carefully controlled. The contents of the crucible should be stirred back and forth, especially when the frothing begins. The oil bath is heated up gradually, and the reaction is soon at an end. The crucible is now closed with a cover having a hole for the thermometer, and the whole kept for 1 hour at a temperature of 175 to 180° C. After this it is cooled to 75 to 80°, the contents of the crucible dissolved in 75 cc. of hot water, cooled, acidified with sulphuric acid, turned into a centrifugal tube, made slightly alkaline with sodium hydrate, whereby only the cellulose remains undissolved, and the cellulose separated in a centrifugal machine, which is used as quicker and more convenient than filtration. The liquid is turned off, the cellulose broken up with a rod and again separated from hot water in the centrifugal machine. The cellulose is finally washed with water, alcohol, and ether, dried, weighed, and ignited in the usual manner. Only substances rich in fat need be previously extracted with ether. A clear white final product is obtained which contains only a very little nitrogen.

Extensive comparisons with the Weende method, Holdefleiss method,

[1] Ztschr. physiol. Chem., 14, No. 3, p. 283.

and the modified method of Hoffmeister are in its favor, although the results agree fairly well among themselves. Better duplicates are, however, obtained by this method. Schultze's method gave too low results.—C. L. PARSONS.

The determination of dry matter in peat, H. PUCHNER (*Landw. Vers. Stat., 46 (1895), No. 2-3, pp. 221-231*).—The author shows that the method used in drying peat and humus soils has a marked influence on the percentages of moisture obtained. It is not possible to reach constant weight by drying samples of peat at higher temperatures (100 to 105° C.) for a certain length of time, and perhaps not for any length of time. When kept in a desiccator the dried samples increased in weight periodically. Drying in vacuo and cooling over phosphoric anhydrid is recommended, but is very lengthy, requiring in some cases 36 days before fairly constant weight was obtained.—F. W. WOLL.

The composition and analysis of condensed milk, T. H. PEARMAIN and C. G. MOOR (*Analyst, 20 (1895), No. 237, p. 268*).—The authors state that condensed milk was first prepared about 1856. They divide the various kinds into 4 classes: (1) Unsweetened milks; (2) sweetened milks; (3) sweetened partly skimmed milks; (4) sweetened skimmed milks. They give the tabulated results of analyses of 50 samples of such milks by the following method: Weigh 10 gm. of the milk and make up to 100 cc. For total solids, 20 cc. of the solution is evaporated in a platinum dish and dried to constant weight, which requires about 6 hours.

Ash is determined in the residue by igniting at low heat.

For protein, 10 cc. of the solution is evaporated to dryness and the nitrogen determined by the Kjeldahl method.

For milk sugar, 10 cc. of the solution is made up to 100 cc. by the addition of 40 cc. of water and 50 cc. of ammonia, and the sugar determined by Pavy's method.

Fat is determined by the Adams method in 10 cc. of the solution.

The authors get satisfactory results for fat by using the Leffmann-Beam machine, when the following procedure is closely followed: Run 10 cc. of the solution into the bottle, add 5 cc. of the hydrochloric-acid fusel-oil mixture, shake well, and add 15 cc. 85 per cent sulphuric acid with agitation. Add sufficient of a hot mixture of sulphuric acid and water (1:2) to bring the top of the liquid nearly to the zero mark, whirl the bottle for 3 minutes, place it in the water oven for 2 or 3 minutes and whirl again, when all the fat will be obtained.—B. W. KILGORE.

Note on commercial condensed milks, A. H. ALLEN (*Analyst, 20 (1895), No. 237, p. 274*).—The author calls attention to the change in composition of condensed milks by comparing the results attained by himself on 29 samples in 1894 with those of Pearmain and Moor (see above). He states that the fat in whole milk is equal to or somewhat greater than the proteids, and a comparison of those gives evidence as to the removal of a portion of the cream.

In making condensed milk the condensation is never more than 3 to 1, and the author regards as particularly objectionable the directions to dilute with 6 to 8 parts of water to restore the milk to its original concentration.—B. W. KILGORE.

Examination of milk (*Ztschr. Nahr. Untersuch. und Hyg.*, 9 (*1895*), *No. 22, pp. 345–347*).—The paper gives the methods of milk analysis adopted by the Association of Swiss Analytical Chemists at their convention in 1895. The milk standards adopted were: Specific gravity of milk at 15° C., 1.029 to 1.034, of milk serum 1.027 to 1.030; minimum content of fat 3 per cent, of solids 12 per cent; minimum acidity (Soxhlet-Henchel method) 45°.—F. W. WOLL.

On the determination of specific gravity of clabbered milk, R. EICHLOFF (*Milch Ztg.*, *24* (*1895*), *No. 18, pp. 779–782*).—The author recommends Weibull's method for the determination of the specific gravity of clabbered milk and buttermilk (E. S. R., 5, p. 644; 6, pp. 11 and 189). Ammonia of known specific gravity is added to the milk in the proportion of about 1 : 10. The mixture is well shaken and its volume and specific gravity determined. The formula given is:

$$\text{Sp. gr. of milk} = \frac{V.y - v.z}{V - v}$$

In which V = volume of mixture, y = sp. gr. of mixture, v = volume of ammonia added, and z = sp. gr. of ammonia.

The specific gravity of the mixture may be taken either with a hydrometer or a picnometer, and may be corrected to 15° C. by the use of the specific gravity tables for milk provided the temperature does not exceed 18° C.—F. W. WOLL.

Method of obtaining fat in cheese for examination, O. HENZOLD (*Milch Ztg.*, *24* (*1895*), *No. 15, pp. 730, 731*).—Three hundred grams of cheese, cut in pieces of the size of a pea and rubbed in a mortar, is shaken in a wide-mouthed flask with 700 cc. potash lye, containing 50 gm. potassium hydrate to the liter, which has been warmed to 22° C. After 5 or 10 minutes the cheese is dissolved and the fat floats on the surface of the solution as small lumps which may be united by gentle shaking. Sufficient cold water to bring the fat up into the neck of the flask is then added, and the fat taken out with a spoon. It is washed with water a few times and worked a little to press out the excess of water. After subsequent melting and filtrating the clear fat is ready for further examination. Comparative experiments made show the correctness of the method.—F. W. WOLL.

A new method of butter examination, E. JAHR (*Milch Ztg.*, *24* (*1895*), *No. 17, pp. 766, 767*).—The butter is melted in a simple apparatus devised by the author, and different samples thereof shaken alternately with (1) water, (2) sulphuric acid, hydrochloric acid, and potassium permanganate solution, and (3) a saturated solution of sodium chlorid, hydrochloric acid, and potassium permanganate solution. The author ascribes the difference in the behavior of butter and oleomargarine fat,

or mixtures of both, to the presence of a casein membrane around the smallest sized fat globules. The application of temperatures over 50° C. (as in the manufacture of oleomargarine) changes the membranes so as to destroy the emulsifying properties of the fat.—F. W. WOLL.

Wollny's milk-fat refractometer, H. TIEMANN (*Milch Ztg., 24 (1895), No. 11, pp. 716-718*).—The method is based on the determination of the refraction coëfficient of a given solution of fat in ether by means of the Wollny milk-fat refractometer. Twenty-five (or 30) cc. of milk is measured into a heavy test tube holding 40 to 50 cc. and shaken with 3 or 4 drops of glacial acetic acid; 5 (or 6) cc. of ether saturated with water at 17.5° C. is then added, and 1 or 2 cc. of potassium hydrate solution. The mixture is then shaken for 5 to 8 minutes, a small portion of the ethereal fat solution placed between the prisms of the refractometer, and the refraction coëfficient determined. The results agree very closely with those of gravimetric analysis. The average of 27 comparative determinations was 2.803 per cent of gravimetric analysis and 2.794 per cent by the above method, the greatest variation being 0.11 per cent.

The potash solution used is prepared as follows: 250 cc. of strong potash lye (1:1) is diluted to 500 cc. with 150 cc. of water and 100 cc. of glycerol; 5 gm. of copper hydrate is added and the mixture heated until the latter is dissolved. The method has been adopted in the work of the Kiel dairy experiment station.—F. W. WOLL.

Contributions to the analysis of fats: V. The determination of unsaponifiable matter; VI. Wool wax, J. LEWKOWITSCH (*Jour. Soc. Chem. Ind., 15 (1896), No. 1, pp. 13-15*).—In the first paper the author points out the disadvantages attending the use of petroleum ether as a solvent for separating the unsaponifiable matters in the analysis of fats and oils and shows that the use of common ether gives much more accurate results. In the second paper the results of a preliminary study of wool fat are given and it is shown that this substance is properly a wax.—A. M. PETER.

The chemist's compendium, C. J. S. THOMPSON (*New York: Macmillan & Co., 1896, pp. VIII+156*).

Chemistry in daily life, L. COHN (*Die Chemie in taglichen Leben. Hamburg and Leipsig: 1896, pp. VII+258*).

Chemical analysis of oils, fats, waxes, and of the commercial products derived therefrom (*From the German of R. Benedikt. Revised and enlarged by J. Lewkowitsch. London: Macmillan & Co., 1896, p. 683*).

On the solubility of silica, A. M. EDWARDS (*Chem. News, 73 (1896), No. 1885, p. 13*).

On the fixation of nitrogen by the metals of the alkaline earths, L. MAQUENNE (*Compt. Rend., 121 (1895), No. 27, pp. 1147, 1148; abs. in Rev. Sci., ser. 4, 5 (1896), No. 2, p. 53*).

The preparation of nitrogen compounds with metals by the direct action of the air and the formation of ammonia, A. ROSSEL and L. FRANK (*Chem. Ztg., 20 (1896), No. 5, p. 38; Jour. Pharm. et Chim., 1896, No. 3, pp. 77-79*).

Determination of the sugar in fruit juices, sirups, liquors, confections, and honey, DE RACZKOWSKI (*Monit. Sci., ser. 4, 1896, No. 10, p. 19; Bul. Assn. Chim. Sucr. et Distill., 13, No. 7, p. 564*).

A chemical study of the glycogen in mushrooms and yeasts, G. CLAUTRIAU (*Bruxelles: F. Hayez, 1895*).

Experimental contributions to the birotation of dextrose, H. TREY (*Ztschr. physikal. Chem., 18, No. 2, p. 193*).

On the multirotation of reducing sugars and isodulcite, TANRET (*Compt. Rend., 122 (1896), No. 2, pp. 86, 87; Rev. Sci., ser. 4, 5 (1895), No. 4, p. 118*).

Remarks on the sugar formed during the autodigestion of yeast, E. SALKOWSKI (*Ztschr. Biol., 32, p. 468; abs. in Chem. Centbl., 1895, II, p. 870*).

Isomaltose, E. FISCHER (*Ber. deut. chem. Ges., 28 (1895), p. 3024; abs. in Chem. Ztg., 19 1895), No. 102, Repert., p. 404*).

Method of preparing mannose, DUYVENÉ DE WITT (*Ztschr. Ver. Rubenz. Ind., 1895, p. 794*).

The formation of citric acid during the oxidation of sucrose, SEARLE and TANKARD (*Chem. News, 72 (1895), p. 255*).

The action of fuming nitric acid on xylose and arabinose, R. BADER (*Chem. Ztg., 19 (1895), p. 1851*).—Xylo-tri-oxy-glutaric anhydrid and arabino-tri-oxy-glutaric anhydrid are formed.—W. H. KRUG.

The action of glyoxylic acid on carbohydrates, C. BÖTTINGER (*Arch. Pharm., pp. 233, 287; abs. in Ber. deut. chem. Ges., 28 (1895), No. 19, Ref., p. 1056*).—Glyoxylic acid changes starch into a soluble modification, sucrose is inverted and with dextrose it forms a sirup of the constant composition $C_8H_{14}O_9+H_2O$. Levulose and galactose give similar sirupy products.

Contributions to the microscopy of honey, K. DIETERICH (*Pharm. Centbl., 1895, No. 16, p. 592; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 329*).

On the oxidation of oils and fatty acids, T. MARIE and W. BISHOP (*Jour. Pharm. et Chim., 1896, No. 2, pp. 55–61*).

Chemical investigations of the seeds of Nephelium lappaceum and the fat contained in them, M. BACZEWSKI (*Monat. Chem., 16 (1895), p. 866; abs. in Jour. Soc. Chem. Ind., 14 (1895), No. 12, p. 1019*).

Optical properties of tannic acid, H. SCHIFF (*Chem. Ztg., 19 (1895), p. 1680*).—Solutions of gallic acid are inactive, but gallotannic acid is dextrorotatory.—W. H. KRUG.

Optical properties and chemical constitution of tannin, F. GÜNTHER (*Pharm. Ges. Ber., 1895, No. 5, p. 297; abs. in Chem. Ztg., 19 (1895), No. 92, Repert., p. 347*).

Note on the estimation of minute quantities of metals in liquids, E. R. BUDDEN and H. HARDY (*Analyst, 21 (1896), No. 238, p. 12*).

Gas volumetric estimation of hydrochloric acid in the contents of the stomach, VON MIERZYNSKI (*Centr. innere Med., 15, pp. 1075–1077; abs. in Jour. Chem. Soc., 1895, Dec., p. 526*).

On the condensation of furfurol with phloroglucin and a new method of quantitative determination of furfurol, B. WELBEL and S. ZEISEL (*Monat. Chem., 16, p. 283; abs. in Bul. Soc. Chim. Paris, 15–16 (1896), No. 1, p. 59*).

On the determination of caffein in tea, VAN LEDDEN-HULSEBOSCH (*Pharm. Centralhalle, 16 (1895), p. 742; abs. in Chem. Ztg., 20 (1896), No. 4, Repert., p. 3*).

Composition of Pachyma cocos and Mylitta lapidescens, E. WINTERSTEIN (*Arch. Pharm., 1895, No. 233, pp. 398–409; abs. in Jour. Chem. Soc., 1896, Jan., p. 63*).

On the simultaneous determination of the mineral and organic acid in beet root, D. SIDERSKY (*Compt. Rend., 121 (1895), No. 27, pp. 1164, 1165*).—Advantage is taken of the indifference of Congo-red paper to the organic acids. A simpler method, however, is to use the coloring matter in the juice itself.

The estimation of sugar in beets, ALMROTH (*Sucr. indig., 1895, No. 46, p. 384; abs. in Chem. Ztg., 19 (1895), No. 92, Repert., p. 348*).

Saccharose and betose, T. L. PHIPSON (*Hawaiian Planters' Monthly, 14 (1895), No. 7, pp. 294–296*).—Two grams of cane and beet sugar, each dissolved in 50 cc. of water containing 1 per cent of hydrochloric acid kept 24 hours in a covered flask at 65° F.

To 5 cc. of each of these solutions 2 cc. of Fehling's solution was added and heated to boiling point; cane sugar solution remains blue, but in case of beet sugar the copper was entirely reduced.

The determination of dextrose or invert sugar in solutions containing lead, ZAMARAN (*Bul. Assn. Chim. Sucr. et Distill., 13, p. 346; abs. in Chem. Ztg., 19 (1895), No. 92, Repert., p. 318*).—Ammonium oxalate is a valuable means of removing the lead.—W. H. KRUG.

The determination of sugar by means of ammoniacal copper solution, PELLET (*Bul. Assn. Chim. Sucr. et Distill., 13, p. 280; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 328*).—The author discusses the method originally proposed by Pavy and lately advocated by Peska, and concludes that it has no advantages over the other methods.—W. H. KRUG.

The determination of moisture in sugarhouse products, WEINBERG (*Bul. Assn. Chim. Sucr. et Distill., 13, p. 278; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 328*).

The so-called nontraceable losses in a sugarhouse, PELLET (*Bul. Assn. Chim. Sucr. et Distill., 13, p. 236; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 328*).—The nontraceable losses in a sugarhouse in reality do not exist, and are due to careless sampling and the inaccuracy of the analytical methods employed.—W. H. KRUG.

A convenient method of weighing the cuprous oxid in the gravimetric estimation of sugars, R. HEFELMANN (*Pharm. Centbl., 36, p. 637; abs. in Chem. Centbl., 1895, II, p. 1091*).—The cuprous oxid is collected in a Gooch crucible, washed, dried, and oxidized by igniting in a current of air. The results are very accurate.—W. H. KRUG.

The determination of moisture in honey by Josse's method, PELLET (*Bul. Assn. Chim. Sucr. et Distill., 13, p. 285; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 328*).

On the estimation of levulose in honeys and other substances, H. W. WILEY (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, p. 81*).

The estimation of tannin in wines, E. MANCEAU (*Compt. Rend., 121 (1895), No. 19, p. 646; abs. in Chem. Ztg., 19 (1895), No. 97, Repert., p. 372*).

Methods employed in detecting adulterations of olive oil, A. MÜNTZ, C. DURAND, and E. MILLIAU (*Ann. Sci. Agron., ser. 2, 2 (1894-'95), Nos. 1, pp. 154-160, charts 5; 2, pp. 161-241*).

Methods of analysis of fats, G. HALPHEN (*Jour. Pharm. et Chim., 1896, No. 2, pp. 81-86*).

Note on the microscopic detection of beef fat in lard, T. S. GLADDING (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, p. 189*).

The use of the calorimeter in detecting adulterations of butter and lard, E. A. DE SCHWEINITZ and J. A. EMERY (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, pp. 174-179*).

A new method of analysis of milk, E. CHUARD (*Chron. Agr. Canton Vaud, 9 (1896), No. 2, pp. 10-12*).—A note on Winter's method, as described in *Bul. Soc. Chim. Paris*.

Unreliability of the creamometer for determining fat in pasteurized milk, CASENEUVE and HADDON (*Bul. Soc. Chim. Paris, 1895, No. 3; abs. in Ztschr. Fleisch. und Milch Hyg., 6, No. 4, p. 77*).—Experiments showed the creamometer to be of absolutely no use for determining fat in pasteurized milk.

On some new methods of testing indigo, B. W. GERLAND (*Jour. Soc. Chem. Ind., 15 (1896), No. 1, pp. 15-17*).

Titrametric determination of uric acid in urine, G. VON RITTER (*Ztschr. physiol. Chem., 21, No. 4, pp. 288-296*).

A sensitive test for recognizing albumen in urine, A. JOLLES (*Ztschr. physiol. Chem., 21, No. 4, pp. 306-310*).

A method for determining uric acid in urine, M. KRÜGER (*Ztschr. physiol. Chem., 21, No. 4, pp. 311-318*).

The determination of the acidity of urine, V. LIEBLEIN (*Ztschr. physiol. Chem., 20 (1895), No. 1-2, pp. 52-58*).

On the determination of chlorin in urine, E. BÖDTKER (*Ztschr. physiol. Chem., 20 (1895), No. 1-2, pp. 193-202*).

On the determination of acidity and alkalinity in urine, E. FREUND and G. TOEPFER (*Ztschr. physiol. Chem., 20 (1895), No. 5, pp. 455-459*).

On the determination of sulphur in urine, P. MOHR (*Ztschr. physiol. Chem., 20 (1895), No. 6, pp. 556-561*).

Acidimetric estimation of vegetable alkaloids—a study of indicators, L. F. KEBLER (*Jour. Frank. Inst., 1896, No. 2, pp. 111-147*).

A new turbine agitator for the laboratory, G. F. JAUBERT (*Bul. Soc. Chim. Paris, 15-16 (1896), No. 1, pp. 9, 10, fig. 1*).

A modified form of the polarization apparatus for chemical uses, H. LANDOLT, (*Ber. deut. chem. Ges., 28 (1895), No. 19, pp. 3102-3104, figs. 2*).—This apparatus is adapted to readings at both very high and very low temperaturos.

Carpenter calorimeter (*Ztschr. Hyg., 1895, p. 1178: abs. in Ztschr. angew. Chem., 1896, No. 2, p. 55, fig. 1*).

Laboratory mill for sugar cane, FONTAINE (*Bul. Assn. Chim. Sucr. et Distill., 13, p. 291: abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 328*).

Miscellaneous chemical investigations, 1882-'93 (*Wisconsin Sta. Rpt. 1893, pp. 286, 287*).—Abstracts are given of the following articles previously published by the station: Analyses of fertilizers (Wis. Sta. An. Rpt. 1886, p. 124), artificial fertilizers and land plasters (Bulletin 11 of the station), miscellaneous chemical and other work (Wis. Sta An. Rpt. 1886, p. 134), methods of butter analysis (Wis. Sta. An. Rpt. 1887, p. 173), notes on Hübl's method of analysis of fats (Wis. Sta. An. Rpt. 1887, p. 179), number and size of fat globules in cows' milk (E. S. R., 2, p. 454).

BOTANY.

Influence of continued electric light on the form and structure of plants, G. BONNIER (*Rev. gén. Bot., 7 (1895), Nos. 78, pp. 241-257; 79, pp. 289-306; 80, pp. 332-342; 82, pp. 409-419, pls. 15*).—The author reports upon a series of experiments conducted with 30 orders of plants, represented by about 75 separate species, studying the effect produced by subjecting them to electric light. The experiments were conducted to ascertain the effect of continued electric light, of light for 6 hours during the day and 6 hours at night, the ordinary conditions of light and darkness, and finally of continued darkness. The experiments were conducted in Paris in a portion of the electric building set apart for the author's use by the Municipal Council.

The plants were kept as nearly as possible at a temperature of 13 to 15° C. The humidity varied from 66 to 72 per cent. The electric light was produced by arc lamps under globes, and the plants were protected against the injurious ultra-violet rays by one or more thicknesses of glass—a spectroscopic study showing that such treatment would cut off a greater portion of these rays. The electric light was maintained day and night for between 6 and 7 months. The plants were arranged at distances varying from 1½ to 4 meters from the lamps, the light being regulated in such a way as to be constant.

The author divides the report into the following heads: (1) The

results of comparison of plants cultivated under continued electric light, normal illumination, and darkness; (2) the variations of structure due to the variation in the intensity of light; and (3) an attempt to cultivate alpine plants in continued electric light and in a humid atmosphere.

It was found that there was considerable change in external appearance of the plants due to the difference in the degree of light, but the modifications in the internal structure were found to be still more marked. It was found, under the influence of the continued electric light, that the chlorophyll was more uniformly distributed throughout all the cells containing it than under ordinary illumination, and it was also found more abundant in the cortex, medullary rays, pith, etc., than in those plants grown under ordinary conditions. The structure of the limb of the leaf was greatly simplified, and the palisade tissue less marked or wholly wanting. The epidermal cells had less thickened walls, and the cortical cells to a great degree lost their special differentiation, such as the formation of sclerenchyma in the petioles of ferns, and the thickening and reduplication of cells of pine, etc. The structure of the stem was also simplified. The cortex was less differentiated into zones, or all its elements were alike. The cork was very tardily or not at all developed. The elements of the cortical tissue, medullary rays, and pith greatly resembled one another. The lignification of the wood fibers was greatly reduced and the inner caliber of the vessels was greatly increased.

The modifications of structure due to different intensities of electric light showed that the differentiation of tissues which is so marked in the above cases is maintained, but in less degree dependent upon the intensity of light.

Experiments conducted with alpine and arctic plants under continued electric light, with a uniformly low temperature and humid atmosphere, showed that the new leaves of the alpine plants which were developed under these conditions acquired a structure identical with that which was naturally presented in the same plants collected in the Arctic regions.

The path of the transpiration current, H. H. DIXON and J. JOLY (*Ann. Bot., 9 (1895), No. 35, pp. 403–420, figs. 7*).—The authors conducted a series of experiments to ascertain whether the path of transpiration is through the lumen or through the cell wall of the conducting wood. Although the weight of testimony is at present in favor of transpiration through the lumen, the authors considered some of the earlier experiments as not without error, and they repeated them under different conditions, eliminating as far as possible all sources of error. They found that the lumen may be stopped with gelatin and paraffin without in any way interfering with the freedom of the cell wall. The rapidity with which the leaves begin to droop seems proportional to the completeness with which the lumina have been closed. When the lumen

is completely closed there is still some upward passage of liquid maintained by the cell wall, but it is probably too feeble to supply the wants of the leaves.

The authors investigated the possibility of the transmission of water through the lumen in the form of vapor, but the results showed that water is not transmitted in this way.

On the influence of sudden changes of turgor and temperature on growth, R. H. TRUE (*Ann. Bot., 9 (1895), No. 35, pp. 365–402*).—The author gives an historical résumé of the literature referring to this subject. The materials used in the experiments were the radicles of young seedlings of *Vicia faba*, comparisons being made with those of *Pisum sativum* and *Lupinus albus*. The methods of manipulation are explained in detail.

The author summarizes the principal results obtained as follows:

"A sudden and decided increase of the concentration of the liquid medium calls forth in growing roots a change of turgor pressure, producing or tending to produce a mechanical contraction, also a more or less prolonged period of retardation of the growth rate. The cause of the retardation was not demonstrated, but is probably due in part to decrease of the turgor pressure and in part to a sensitive reaction following the irritation of the living organisms.

"A sudden and decided decrease of the concentration of the medium causes a change of turgor pressure, producing a mechanical elongation, also a more or less prolonged period of retardation of growth. The cause of the retardation is found in a sensitive reaction of the living organisms to the change of medium. Since a reduction of growth is found to accompany both an increase and a decrease of turgor pressure, it follows that growth and turgor pressure here stand in no directly proportional relation to each other. . . .

"Following a sudden fall or a sudden rise of the temperature between 18 to 21 and 0.5 to 1.5° C. as extremes, the first effect seen is a slight turgor change due to physical causes, producing or tending to produce a shortening in length if the temperature be lowered or, in case the temperature be raised, producing an elongation.

"Following this mechanical action, a period of depressed growth usually follows. The duration of the depression period depends on the position of the lower temperature limit and on the length of time of exposure to this temperature. The depression is regarded as the irritable response to the stimulus furnished by the exposure to the low temperature followed by the sudden change to the higher degree. The duration of the depression may be increased by lowering the minimum temperature limit and by lengthening the period of exposure. An exposure to the lower temperature for less than a certain period of time is followed by no noticeable depression.

"Changes of temperature between 18 and 30° C. as extremes seem to be followed by turgor changes only. That no momentary depression of the growth rate takes place is hardly to be asserted. Indeed, it is likely that such takes place, but by reason of the slightness of amplitude becomes lost in the more striking spontaneous changes. It is also to be borne in mind that a slight uncontrolled interval follows the change of temperature. That in this interval a slight effect might have escaped observation is also not out of the question."

On the influence of the root tubercles of Alnus glutinosa upon the fixation of nitrogen, L. HILTNER (*Landw. Vers. Stat., 46 (1895), No. 2–3, pp. 153–161, pl. 1*).—The author gives the results of his experiments in growing the common alder in inoculated and uninoculated

media. It is shown that young alders without root tubercles and not receiving any combined nitrogen are unable to assimilate atmospheric nitrogen and the plants are poorly developed Where through inoculation the roots are provided with tubercles the plants are able to make use of the nitrogen, as is the case with the Leguminosæ. In nitrogen containing soils the production of tubercles is diminished or stopped entirely, while their production is increased in proportion as the soil becomes poorer in available nitrogen. During the early stages of the tubercle the organism lives as a parasite, but when fully devel oped the plant receives a decided benefit from its presence. The organisms of the alder tubercles, unlike those of the pea, are said to be efficient in water cultures. Through the addition of nitrates to the nutrient solution the development of the tubercles is greatly checked, if not entirely stopped.

The author's conclusions are said to be in confirmation of those of R. Dinger,[1] who also concluded that the alder is able to assimilate free nitrogen only when supplied with tubercles.

On the utilization of elementary nitrogen by mustard, T. PFEIFFER and E. FRANKE (*Landw. Vers. Stat., 46 (1895), No. 2-3, pp. 117-151, pl. 1*).—The authors review and criticise the work of various authors relative to this subject, and they point out various statements of Liebscher[2] to which they take exceptions.

The plan of their work was to conduct pot experiments, growing first peas and then mustard in the same soil but under various conditions. The pots were divided into 3 series of 6 each, (1) sterilized, (2) steril ized and then inoculated, and (3) unsterilized. When planted with mustard half the pots of each series received 1.2 gm. of nitric nitrogen. To all pots the necessary minerals were added. Where the nitrate was added a decidedly greater amount of nitrogen was found in the product, although no nitrogen balance was given, but deducting from these pots the nitrogen in the product where no nitrogen was added the results were practically equal, showing that soil bacteria were without effect on the yield of nitrogen in the mustard. The authors think that their results point to the conclusion that mustard can not utilize elementary nitrogen.

Plant breeding, L. H. BAILEY (*New York: Macmillan & Co., 1895, pp. 293, figs. 20*).—This volume is largely based upon two lectures delivered by the author in the University Extension course of the School of Biology of the University of Pennsyl vania and one presented before the Massachusetts State Board of Agriculture. No attempt has been made to collect lists of varieties, but rather to give brief statements of the principles underlying the amelioration of plants, sufficient examples being given to fix the principles in mind. As the production of new varieties can not be grasped without a knowledge of the fundamental principles underlying the subject, the author has devoted two chapters to the philosophy of the variation and crossing of plants. These principles are discussed under the following heads: Existence of individuality, cause of individual difference, choice and fixation of

[1] Landbouwk Tidschr., 1895, pp. 167-192.
[2] Deut. landw. Presse, 1892, No. 104, p. 1080.

varieties, the struggle for life, division of labor, limits of crossing, functions of the cross, characteristics of the crosses, and the uncertainties of pollination. Under the discussion of the origination of domestic varieties the author lays down 15 rules for the guidance of the plant breeder and several specific examples are given showing how the breeder can control and mold the new variety to suit his fancy.

Extensive quotations are given from the works of Verlot on the classification of varieties of ornamental plants, Carrière on bud variations, and Focke on the characteristics of crosses. A chapter is given upon pollination in which the structure of the flower, manipulations necessary, and implements required are figured and fully described. A glossary and index complete this valuable contribution to organic evolution as well as to plant breeding.

This volume is one of the Garden Craft series, issued by the publishers, and will no doubt be well received by botanists, horticulturists, gardeners, and others interested in the subject of the improvement of cultivated plants.

Ethno-Botanic Gardens, J. W. HARSHBERGER (*Science, n. ser., 3 (1896), No. 58, pp. 203–205*).—The author makes a plea for the foundation of gardens in which only those plants known to have been of use to the aborigines should be grown. Directions are given for a grouping of the plants and numerous species are enumerated.

Notes on Carex, L. H. BAILEY (*Bot. Gaz., 21 (1896), No. 1, pp. 1–8, pl. 1*).—The author states his position upon the nomenclature question and describes 11 new species and varieties of Carex.

Ochropsora, a new genus of Uredineæ, P. DIETEL (*Ber. deut. bot. Ges., 13 (1895), No. 8, pp. 401, 402*).

Comments on Kerner and Oliver's Natural History of Plants, C. MACMILLAN (*Bot. Gaz., 21 (1896), No. 1, pp. 20–25*).—The author reviews portions of the above work and comments unfavorably upon some of the statements.

Criticisms of Nash's new or noteworthy American grasses, F. LAMSON-SCRIBNER and J. G. SMITH (*Bot. Gaz., 21 (1896), No. 1, pp. 14–19*).—The authors question the validity of some of the changes made in the nomenclature of some of the grasses in the above papers published in Torrey Bulletin.

New species of fungi, J. B. ELLIS and B. M. EVERHARD (*Proc. Phila. Acad. Sci., 1895, No. 3, pp. 413–441*).—Notes and descriptions are given of about 100 new species of fungi from various localities, principally from the United States.

A false bacterium, H. MARSHALL WARD (*Ann. Bot., 9 (1895), No. 36, pp. 657, 658*).—A brief description is given of a branching organism that responds to many of the tests for bacteria, but it is, according to the author, a form of a true fungus.

Culture experiments with heterœcious fungi, H. KLEBAHN (*Ztschr. Pflanzenkrank., 5 (1895), No. 6, pp. 327–333*).—Experiments with *Triphragmium ulmariæ*, *Æcidium valerianæ*, *Puccinia coronata*, and *P. coronifera* are reported upon at considerable length.

Mucor and Trichoderma, J. RAY (*Compt. Rend., 122 (1896), Nos. 1, pp. 44–46; 6, pp. 338, 339*).—Notes are given of *Trichoderma* sp. growing upon Mucor. The author states that the parasitism is facultative, each being able to grow separately.

Concerning molds and the preparation of mold fungi, G. MARPMANN (*Ztschr. angew. Mikros., 1 (1895), No. 9, pp. 262–269*).

The prototypes of fungi, G. MASSEE (*Nature, 53 (1896), No. 1371, p. 311*).—A review is given of A. Möller's work on Protobasidiomycetes.

On some constituents of the cell, J. E. HUMPHREY (*Ann. Bot., 9 (1895), No. 36, pp. 561–579, pl. 1*).

On the structure of the root, H. WAGER and N. WALKER (*Internat. Jour. Micr. and Nat. Sci., ser. 3, 6 (1896), No. 29, pp. 67–76, pl. 1*).

On the physiology of woody plants, K. G. LUTZ (*Stuttgart: E. Nägele, 1895; abs. in Bot. Ztg., 54 (1896), II, No. 2, pp. 25–27*).

On the porosity of woody stems, H. DEVAUX (*Mem. Soc. Sci. Phys. et Nat. Bordeaux, ser. 3, 5 (1895), pp. 365–396, figs. 3*).

The physiology of tendrils, C. CORRENS (*Bot. Ztg., 54 (1896), No. 1, pp. 20*).—Studies were made of *Sicyos angulatus*, *Passiflora gracilis*, and comparisons made with numerous genera of Cucurbitaceæ, Passifloriaceæ, Leguminosæ, Polemoniaceæ, Sapindaceæ, Ampelidineæ, and Smilaceæ.

A study of the mechanics of plant twining, R. KOLKWITZ (*Ber. deut. bot. Ges., 13 (1895), No. 10, pp. 495–517, pl. 1*).

The oxidizing ferments in fungi, E. BOURQUELOT and G. BERTRAND (*Bul. Soc. Mycol. France, 12 (1896), No. 1, pp. 18–26*).—The authors give a report upon the presence or absence of oxidizing ferments in a large number of fungi, mostly mushrooms, examined by them.

Researches in transpiration and assimilation, A. F. WOODS (*Bot. Gaz., 21 (1896), No. 1, pp. 26–33*).—The author reviews some of the more recent literature relative to the above subjects under the following heads: Transpiration experiments, rôle of the stomata in the exchange of gases during assimilation, and prejudicial effect of an increased amount of salt in the substratum on assimilation.

Upon the coloration of the tissues and liquid contents of certain mushrooms when exposed to the air, E. BOURQUELOT and G. BERTRAND (*Bul. Soc. Mycol. France, 12 (1896), No. 1, pp. 27–32*).—These studies were principally made on species of Boletus, Lactarius, and Russula.

On the development of the perithecia of Sphærotheca castagnei, R. A. HARPER (*Ber. deut. bot. Ges., 13 (1895), No. 10, pp. 475–480, pl. 1*).

Rhus poisoning, G. M. BERINGER (*Amer. Jour. Pharm., 68 (1896), No. 1, pp. 18–20*).

Early experiments in crossing plants, E. J. HILL (*Garden and Forest, 9 (1896), No. 113, pp. 32, 33*).—References are given to the artificial production of hybrids at an earlier date than that usually considered as the beginning of such experiments.

Notes on the study of the cross fertilization of flowers by insects, I. A. KELLER (*Proc. Phila. Acad. Sci., 1895, No. 3, pp. 555–561*).

On the transmission of ancestral forms by plants, E. ROZE (*Jour. Bot. France, 10 (1896), No. 1–2, pp. 15–21*).

Some adaptations of water plants to their surroundings, W. FALCONER (*Internat. Jour. Micr. and Nat. Sci., ser. 3, 6 (1896), No. 29, pp. 61–67*).

Researches upon the effect of drought on plants, E. GAIN (*Paris: Imp. Nationale, 1895, pp. 28*).

The influence of recent stages of development upon future plant organs, S. SCHWENDENER (*Sitzungsber. k. preuss. Akad. Wiss. Berlin, 19 (1895), pp. 18; abs. in Forsch. Geb. agr. Phys., 18 (1895), No. 5, p. 483*).

Two new Idaho plants, J. M. HOLZINGER (*Bot. Gaz., 21 (1896), No. 1, p. 36*).—*Fragaria helleri* and *Rosa macdougali* are described as new.

The cacti of Lower California, WEBER (*Bul. Museum Nat. Hist. Paris, 1895, No. 8, pp. 310–321*).—*Cereus cumengei*, *C. digueti*, *Echinocactus peninsula*, *Opuntia cholla*, and *O. alcahes* are described as new.

Some new western plants, E. L. GREENE (*Proc. Phila. Acad. Sci., 1895, No. 3, pp. 546–554*).—Descriptions are given of a number of new species of western plants, together with a revision of the genus Tropidocarpum.

Poisoning plants, F. W. CARD (*Garden and Forest, 9 (1896), No. 410, p. 8*).—Notes are given of the effect of various poisons upon plants.

METEOROLOGY.

Meteorological observations, 1894, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1894, pp. 158–160*).—This includes comments on the character of the season, monthly summaries of observations at Storrs on atmospheric pressure, temperature, relative humidity, precipitation, and cloudiness, and a record of rainfall at 23 localities in the State during the 6 months ending October 31.

"The total precipitation for the year (33.3 in.), as measured at the station, was far below the average. The average annual precipitation for 6 Connecticut stations of the New England Meteorological Society, having records covering a period of 10 or more years prior to 1890, is 49.1 in. The average at Storrs for 5 years ending with 1893 is 46.8 in., and including 1894 the average for 6 years is 44.5 in. The monthly precipitation was least during the growing season (May-November). In many places the drought became unusually severe during June and July, so that the hay and grain crops suffered considerably.

"The temperature for January was a little above the average, while February was 3 degrees below the average, and March several degrees above. The spring opened later than usual. The last severe frost occurred May 15, doing considerable damage to early vegetables. The summer was quite hot and dry, with light rainfalls till September. Very light frost appeared on low ground September 12, and the first killing frost occurred September 26. This gave a growing season of 131 days since the last killing frost in the spring, while the average growing season since the station began observations in 1888 is 113 days. The temperature for September and October was above the average, and the conditions were favorable for harvesting most crops. Heavy snow came unusually early (November 6), and many farmers had turnips and celery badly frosted.

Rainfall record, W. H. HEILEMAN (*Iowa Sta. Bul. 28, pp. 237, 238*).—A record of the rainfall for each month from March, 1894, to February, 1895, inclusive. The total for the year ending February 28, 1895, was 22.29 in.; for the 6 months ending August 31, 1894, 12.17 in.

Meteorological observations, A. MACKAY (*Canada Exptl. Farms Rpt. 1894, pp. 384, 385*).—Tabulated data for temperature, sunshine, and rainfall at the experimental farm at Indian Head, Northwest Territory of Canada (longitude 102° west, latitude 52° north, altitude about 2,000 ft.).

AIR—WATER—SOILS.

Studies relating to ground water and soil moisture, F. H. KING (*Wisconsin Sta. Rpt. 1893, pp. 167-200, figs. 11*).—A summary is given of work in this line commenced in 1889 and described in Annual Reports of the station for 1889, p. 189; 1890, p. 134 (E. S. R., 2, pp. 432, 442); 1891, p. 91 (E. S. R., 4, p. 121); 1892, p. 94 (E. S. R., 5, p. 483), together with additional data secured during 1893. Most of this article is a revised reprint of those referred to above, and includes explanations and suggestions regarding the relation of the surface of the ground water and the topography of the land; the water level in wells; depth of wells; contamination of wells; the surface of standing water between tile drains; natural subirrigation; the capacity of soils for water; variations of storage capacity of soils for water, with length of time between rains and the distance above standing water in the ground; the proportion of soil water which crops are able to use; loss of water by evaporation; rise of water by evaporation; rise of water by capillarity; capillary movement of water in dry soils; translocation of capillary soil water; conservation of soil moisture by spring and fall plowing, by harrowing, and by soil mulches; influence of cultivation to different depths on moisture and temperature; influence of diurnal

changes of soil temperature on percolation; influence of barnyard manure on soil moisture; and influence of potassium nitrate on the upward capillary movement of soil water.

Storage capacity of soils for water.—Data are given which show that the upper 5 ft. of soil on the station grounds can store 110.5 lbs. (21.24 in.) of water. This represents 2,406.69 tons of water per acre, and is sufficient for the production of 7.76 tons of dry matter in corn.

"[It is further shown] that the water-holding power increases with the fineness of the soil and decreases with the distance above standing water, at least up to 10 ft.; but the most striking fact is that the water-holding power of the upper portions of the several [soil] columns is very much less than that of the lower sections.

"These experiments show very clearly that the extreme drying out of soils during periods of small rainfall is not in all cases due wholly to evaporation from the surface or through vegetation growing upon it; on the contrary, the water may be slowly percolating downward beyond the reach of the roots of any of our crops in localities where the level of ground water or the structure of the soil does not prevent it.

"Plants are unable to withdraw the moisture from soils completely, and on this account also only a portion of the really large amount of water soils may contain is available for crop production. In the first place, soils entirely full of water can not support farm crops because there is then an insufficient supply of air to maintain life, and experiments have proven that crops do best when the soil contains from 50 to 60 per cent of the water it will hold; but this statement should be understood as applying only to the upper 1 or 2 ft. of soil, because as the season advances the percolation downward and the loss of water from the surface and through the pumping action of the roots gradually reduces the water of the subsoil to the proper amount. In the second place, when the clayey soils of our State have lost all but about 9 per cent and the sandy soils all but about 6 per cent of their dry weight of water, crops begin to wilt and growth to cease.

"It follows, therefore, that of the 2,406.69 tons of water the upper 5 ft. of soil may contain per acre, only 1,168 tons would be available, even were there no percolation downward beyond the reach of root action and no evaporation from the surface, which, of course, will never be true."

Influence of barnyard manure on soil moisture.—The general facts brought out by 3 years' study of the influence of barnyard manure on the moisture of bare soils are stated to be as follows:

"(1) When a coarse manure is plowed in, its first effect is to allow the soil which lies above it to dry out more rapidly than if the manure were not present. This is because the manure, at first, does not rapidly transmit the capillary water in the soil below to the surface layer above.

"(2) It follows from this fact that coarse manures, when plowed under during a dry time, may retard the early growth of crops by depriving them of the deeper soil moisture which would be available at once were the manure not there.

"(3) Barnyard manure has a general tendency to leave the upper 3 ft. of soil more moist than they would be without it, and the dryer the season and the more thorough the manuring the more marked will be its influence. The mean observed difference in the water content of the upper 3 ft. of soil, as indicated by 7 determinations during 3 years, shows that the surface foot of manured fallow ground may contain 18.75 tons more water than similar unmanured ground will, the second foot 9.28 tons more per acre, and the third foot 6.38 tons more, making an aggregate of 34.41 tons of water per acre in soil which is treated with barnyard manure more than will be found in similar soil not manured.

"(4) [A soil] which was manured lost, by surface evaporation, at the rate of 4.98 lbs. per sq. ft. more than the unmanured surface did during 105 days, which is at the rate of 108.5 tons per acre. . . . In another experiment it was found that wetting the surface of a sand with the liquid which leaches from barnyard manure decreased the height to which water was lifted 16 in. and the rate of evaporation from the surface 49.64 per cent. . . .

"(5) The results appear also to indicate that in some manner the barnyard manure tends not only to maintain in the upper 3 ft. of field soil a larger amount of water than it would otherwise have, but at the same time to decrease that which the succeeding 3 ft. may retain. Some of my observations on the comparative influence of deep and shallow cultivation appear also to indicate that here too the cause which leaves the surface soil more moist tends to leave the deeper soil dryer. . . .

"Although much larger yields of dry matter of corn per acre were produced on the manured ground than on that unmanured, the amount of water in the soil at the end of the growing season was almost as great upon the manured soil as it was upon the other; and yet the differences in yield were so great as to demand either that it takes less water to produce a pound of dry matter on manured than on unmanured ground, or else the manured soil has the power of supplying water to the corn which the unmanured soil has not."

Influence of potassium nitrate on the upward capillary movement of soil water.—"[Twenty glass tubes 18 in. long and 1 in. in diameter were] filled with the same kind of coarse plastering sand, screened through a sieve of 16 meshes to the inch; but the sand for one set of 10, before being packed in the tubes, was wet with distilled water until it contained 12 per cent of its dry weight; while the other was wet with distilled water containing 0.08 per cent of potassium nitrate.

"The sand in the tubes extended to the bottom, the lower ends of each column standing 2 in. in water. A small pinhole was provided in each of the water receptacles below to equalize the air pressure, and this was the only chance for evaporation, except from the surface of the sand at the top of the tubes. The pieces of apparatus stood upon a table in the laboratory in a single row, forming an alternating series, so as to avoid differences which might result from variations of temperature or of air currents. The whole experiment lasted 23 days, during which the pieces were weighed 10 times; but at the end of 8 days the pieces of apparatus were emptied and again refilled, but this time putting the sand containing the potassium nitrate in the pieces which before contained the distilled water, so as to eliminate the individuality of the pieces of apparatus. The total evaporation from the pieces of apparatus during the 2 periods was for distilled water containing potassium nitrate 315.66 gm., distilled water 256.97 gm.; difference 58.69 gm., or 22.84 per cent.

"That is to say, the capillary movement upward and evaporation from the surface was 22.84 per cent greater under the influence of 0.08 per cent of potassium nitrate than it was under the influence of the distilled water.

"This experiment has been twice repeated with brass tubes 22 in. long substituted for the glass ones, and with results in the same direction, but smaller, and while there have been cases of individual pairs of tubes where the results have been reversed, there has never been a set of weighings where the sum of the water evaporated from the sand wet with the water containing the potassium nitrate was not in excess of that from the other set."

The amount of water required by different crops to produce a pound of dry matter in Wisconsin, F. H. KING (*Wisconsin Sta. Rpt. 1893, pp. 152–159, fig. 1*).—This is a continuation of experiments "to learn how much water is required to produce a pound of dry matter by some of our leading crops." Details of previous experiments will be found in Annual Reports of the station for 1891 and 1892 (E. S. R., 4, p. 126; and 5, p. 484). "Barley, oats, and clover have each been tested

in duplicate during 2 years, corn during 3 years, and field peas 1 year." The results are summarized in the following table:

Water required to produce 1 lb. of dry matter, and the relation of the experimental yields and water used to the field yields and the season rainfall.

	Water required for 1 lb. of dry matter.	Relation of— The water used to the season's rainfall	The yield to the field yield.
	Pounds		
Barley	392.98	2.7 times	2.6 times
Oats	505.7	2.8 times	1.4 times
Clover	452.86	1.9 times	2.4 times
Dent corn	309.84	1.8 times	2.6 times
Flint corn	233.9	2.2 times	2.7 times
Average		2.28 times	2.34 times

"From this table it is seen that under the conditions of the several trials the crops experimented with were able to utilize, on the average, 2.28 times the water which fell as rain during the growing season, and that, in having it to use, yields averaging 2.34 times what are called large field yields were produced.

"It does not, of course, follow from these experiments that well tilled fields, if irrigated properly, will produce such yields as those recorded here; neither does it follow, necessarily, that these large yields owe their excess over normal crops simply to the extra supply of water added at the proper times. I believe, however, it does follow from these experiments that, were our water supply under better control and larger at certain times, our field yields would be much increased if not actually doubled. It does follow, also, that well drained lands in our State are not supplied naturally with as much water as most crops on them are capable of utilizing, and hence that all methods of tillage which are wasteful of soil moisture detract so much from the yields per acre. What we call good average yields per acre are determined in a large measure by the amount of water which is available to the crop during its growing season, and what we call good yields would be much larger under a larger supply of moisture applied at just the right times."

The natural distribution of roots in field soil, F. H. KING (*Wisconsin Sta. Rpt. 1893, pp. 160–161, figs. 9*).—Data from observations in continuation of those noted in the Annual Report of the station for 1892 (E. S. R., 5, p. 480) on the root growth of corn, oats, barley, and clover are reported, with numerous illustrations. The ratio of the dry matter of the roots to that of the tops is shown in the following table:

Dry matter in roots and tops of different crops.

	Corn		Oats.		Barley.		Clover.	
	Top.	Root	Top.	Root.	Top	Root	Top.	Root
Pounds	460.5	68.5	150.7	67.3	57.6	17.07	59.77	15.49
Ratios	6.723	1	2.239	1	3.374	1	3.859	1

The distribution of the salts in alkali soils, E. W. HILGARD (*California Sta. Bul. 108, pp. 14, charts 3*).—It is pointed out that the rise of alkali brought about by irrigation is not necessarily due to the saline

character of the irrigation water used, but to the fact that the alkali salts are simply brought up by evaporation from the soil itself. Rainfall in regions where alkali occurs rarely wets the soil to a greater depth than 3 ft., hence there is an accumulation of alkali at this depth. When, however, irrigation water is applied to the soil an upward movement of soil water sets in and the soluble salts rise to the surface. The bulk of alkali salts even in natural alkali lands is therefore accumulated within easy reach of the surface and underdrains, and if this accumulation is once removed there is little danger that sufficient alkali to do any harm will ever again come from below. Charts are given which show that the proportion of carbonate of soda (black alkali) decreases as the surface is approached, and confirm the conclusion "that whenever an alkali soil is subjected to the action of stagnant water or abundant moisture without aëration the formation of black alkali will take place"

Investigations concerning the influence of the mechanical working of the soil on its fertility, E. WOLLNY (*Forsch. Geb. agr. Phys., 18 (1895), No. 1-2, pp. 63-75*).—A 3 years' trial was made on 39 plats, 4 square meters in area, divided into 3 series. The first series remained untilled; the second series was spaded 36 cm. deep, the upper 18 cm. being removed, while the 18 cm. of subsoil was loosened; the third series was spaded 18 cm. deep. The loose, calcareous, alluvial soil contained humus, was uniform, and rested on a pervious subsoil. The land had been manured with a complete fertilizer and potatoes grown on it during the previous 4 years. In the first year of this experiment no fertilizer was used except on those plats on which the effect of loosening and manuring were tried simultaneously; to these poudrette was applied at the rate of 500 kg. per hectare. In the second year the plats manured the first year received no fertilizer and the others received a mixture of equal parts of poudrette, superphosphate, and kainit. The third year was like the first, except that poudrette, superphosphate, and kainit were applied to the plats that then received poudrette alone.

Various crops were grown. There was no tillage after sowing, but the plats were kept free from weeds. The yields are tabulated.

The author states that the nature of the soil was not favorable for the purpose of the experiment, and that the results obtained have only a limited value. He concludes that loosening the soil increased the fertility; that deep tillage, contrasted with shallow, increased the yields of all crops, but to a different degree with different kinds; that the effect of fertilizers applied increased with the depth of tillage; and that the effect of manuring is essentially dependent on the physical state of the soil, being more favorable the better the mechanical condition and conversely.

A simple and convenient apparatus for estimating the water-holding power of soils, J. L. BEESON (*Jour. Amer. Chem. Soc., 17*

(1895), No. 10, pp. 769–771, fig. 1).—A burette is connected with a Y-tube, one arm of which carries a pinchcock and the other is connected by rubber tubing with a small Stutzer extraction tube fitted with a perforated disk covered with filter paper and fastened at the center with a glass tube which reaches above the top of the extraction tube. In operation "the apparatus is filled with water, the burette raised so as to cover the disk and filter paper and then lowered. The excess of water will now run out of the filter paper so that the reading will become constant within 5 minutes. Then by means of the pinchcock water is slowly drawn off until it stands at the zero mark on the neck of the tube and at zero on the burette. From 25 to 50 gm. of soil, according to the water-holding power of the sample, is added to the large tube, which is gently tapped until the soil is level. The burette is raised and the water gently forced into the soil from below until it forms a level above the soil. From the height of the column of water in the air tube the amount of pressure may be seen. The burette is then lowered and the water runs out of the soil by gravity alone, since the space below the disk is supplied with air through the tube. When there is no more rise of water in the tube, which requires about 15 to 20 minutes, the burette is raised until the water stands at the zero mark in the tube, when the number of cubic centimeters of water absorbed by the soil is read on the burette. The whole time for an analysis need not exceed 30 or 40 minutes."

On the percentage of argon in atmospheric and respired air, A. KELLAS (*Proc. Roy. Soc., 59 (1896), No. 353, pp. 66–68*).

Winds and currents upon the coast of Gascony, HAUTREAUX (*Mem. Soc. Sci. Phys. et Nat., ser. 4, 5 (1895), pp. 419–435*).

Chemical vs. bacteriological examination of potable water, W. P. MASON (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, pp. 166–168*).

Well waters, F. T. SHUTT (*Canada Exptl. Farms Rpt. 1894, pp. 175–178*).—Analyses with reference to drinking quality of 50 samples of water are reported.

Examination of potable water (*Ztschr. Nahr. Untersuch. und Hyg., 9 (1895), No. 24, pp. 380–385*).—Methods of chemical and bacteriological examination of potable water, adopted by the Association of Swiss Analytical Chemists in 1895, are given.—F. W. WOLL.

Investigations regarding evaporation, E. WOLLNY (*Forsch. Geb. agr. Phys., 18 (1895), No. 5, pp. 486–516*).

Russian investigations on the water question, W. VON WIENER (*Forsch. Geb. agr. Phys., 18 (1895), No. 5, pp. 413–454*).—The author reviews investigations on this subject in Russia and elsewhere and concludes that the farmers can control drought effectively by influencing the water requirements of plants, but that scientific investigations of not only the relative transpiration of plants but also the individual behavior of different kinds of plants to the soil moisture has been very limited and unsatisfactory.

The drought of 1893, L. GRANDEAU (*Ann. Sci. Agron., ser. 2, 2 (1894–'95), No. 2, pp. 242–270*).—The influence of this drought on forest growth and on crops grown under different conditions of culture and manuring, and the influence of subsoiling on the conservation of soil moisture are discussed.

Defects of moor culture up to the present time and suggestions as to their removal, M. H. SCHWEDER (*Deut. landw. Presse, 23 (1896), No. 8, pp. 59, 60*).

The soils of Texas—a preliminary statement and classification, E. T. DAMBLE (*Trans. Texas Acad. Sci., 1 (1895), No. 4, pp. 25–60, map 1*).

Virgin soils of Canada, F. T. SHUTT (*Canada Exptl. Farms Rpt. 1894, pp. 149–157*).—Data regarding physical characteristics and chemical composition are reported for soils from British Columbia, Manitoba, Ontario, Quebec, New Brunswick, and Prince Edward Island.

Report on soils, W. MAXWELL (*Hawaiian Planters' Monthly, 14 (1895), No. 12, pp. 577–593*).

FERTILIZERS.

The fertilizing value of barnyard manure, M. MÄRCKER (*Ztschr. landw. Cent. Ver. Sachsen, 52 (1895), No. 2, p. 58*).—Experiments at the Halle Station are briefly referred to, which indicate that the phosphoric acid of manure has 85 per cent of the effectiveness of water-soluble phosphoric acid, and that almost all of its influence is exerted the first season. The effectiveness of the nitrogen of solid dung was found to be only about 10 per cent of that of nitrate of soda, while that of the liquid excrement was over 90 per cent. The effectiveness of the nitrogen of the solid manure did not appear to be increased by applying the solid and liquid manure together. It also appears from experiments at the station that while manure rarely contains more than 2 to 3 per cent of its total nitrogen in the form of nitrates, 37 per cent is capable of being converted into such form under favorable conditions.

Of a number of manure preservatives used water-soluble phosphoric acid gave the best results, at the same time not interfering with nitrification. Sulphuric acid and fluorin compounds were also effective, but they hindered nitrification and other desirable fermentations.

Ground leather, M. MÄRCKER (*Ztschr. landw. Cent. Ver. Sachsen, 52 (1895), No. 2, p. 56*).—Experiments at the Halle Station with this substance have given the following results:

Dry matter and nitrogen in crop grown with and without ground leather.

Fertilizers	Dry matter in crop	Nitrogen in crop.
	Grams	*Grams*
Without nitrogen	19.9	0.430
1.5 gm. of nitrogen in ground leather	20.5	0.422
3 gm. of nitrogen in ground leather	22.1	0.470
3 gm. of nitrogen in nitrate of soda	42.1	1.145

Coöperative field experiments with fertilizers, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1894, pp. 161–173*).—Accounts are given of experiments at the station and on 5 farms in the State on the same line as that followed in previous years (E. S. R., 6, p. 398), but "as the station has taken up so many other lines of work it has been thought best not to continue 'soil tests' as a regular branch of the work, but as far as individual farmers wish to test their own soil, to give instruction and advice."

Data relating to kind, amount, and cost of fertilizers, yield of shelled corn, per cent of dry matter in shelled corn, weight of shelled corn per bushel, proportion of good and poor corn, and weight of stover are summarized for each experiment. The yields of the different crops on the station soil test plats during the past 5 years are also tabulated.

Potash experiments, M. MÄRCKER (*Ztschr. landw. Cent. Ver. Sachsen, 52 (1895), No. 2, pp. 60–62*).—Experiments at the Halle Station during a number of years, including wet, dry, and moderately dry seasons, showed that applications of from 800 to 1,200 lbs. of kainit per acre were practically without effect during very wet or very dry seasons. In moderately dry seasons, however, there appeared to be some benefit due apparently to conservation of moisture by the potash salts and especially by the associated salts in the kainit. In the wet season of 1894 1,200 lbs. of kainit per acre did not affect the sugar content of beets. Beets fertilized with nitrate of potash grew more slowly and produced more leaves and retained them longer than beets fertilized with nitrate of soda.

Analyses of commercial fertilizers (*New York State Sta. Bul. 92, n. ser., pp. 211–263*).—This includes the text of the State fertilizer law, with comments, a discussion of the influence of different kinds of plant food upon plants, explanations of terms used in fertilizer analysis, notes on valuation of fertilizers, and tabulated analyses and valuation of 260 samples of commercial fertilizers representing 232 different brands collected during the spring of 1895.

"Of the 232 different brands collected, 136 were below the manufacturer's guarantee analysis in one or more constituents, in amounts varying from 0.01 to 3.78 per cent.

"The amount of nitrogen was below the guarantee analysis of the manufacturer in 73 brands, the deficiency varying from 0.01 to 3.21 per cent and averaging 0.36 per cent. In 44 of the 73 brands, the deficiency was less than 0.25 per cent; in 10 brands, it was over 0.25 and below 0.50 per cent; in 11 brands, it was over 0.50 and below 1 per cent; in 6 brands, the deficiency was over 1 and below 2 per cent; and in 2 brands, it was over 3 per cent.

"The amount of phosphoric acid was below the manufacturers' guarantee analysis in 56 brands, the deficiency varying from 0.06 to 3.78 per cent and averaging 0.66 per cent. In 20 of the 56 brands, the deficiency was less than 0.25 per cent; in 13 cases, it was above 0.25 and below 0.50 per cent; in 11 brands, it was above 0.50 and below 1 per cent; in 7 brands, the deficiency was above 1 and below 2 per cent; in 3 brands, it was above 2 and below 3 per cent; and in 2 cases, it was above 3 per cent.

"The amount of potash was below the manufacturer's guarantee analysis in 41 different brands, the deficiency varying from 0.01 to 3.56 per cent and averaging 0.57 per cent. In 14 of the 41 brands, the deficiency was below 0.25 per cent; in 10 brands, it was above 0.25 and below 0.50 per cent; in 13 brands, it was above 0.50 and below 1 per cent; in 2 brands, the deficiency was above 1 and below 2 per cent; in 1 brand, it was above 2 and below 3 per cent; and in 1 brand, it was over 3 per cent."

Deep culture with underground manuring, W. VON FUNKE (*Jour. Landw., 43 (1895), No. 1–2, pp. 13–47, fig. 1*).

Does the reversion of water-soluble phosphoric acid in the soil impair the effectiveness of superphosphates? ULLMANN (*Fühling's landw. Ztg., 44 (1895), No. 24, pp. 772–774*).—A popular review of the work of Stahl, Schröder, Gerlach, Märcker,

Wagner, and the author tending to show that the reversion of the phosphoric acid of superphosphates in the soil does not render it at once unavailable.

Value of phosphoric acid in bone (*Rural New Yorker, 1896, Jan. 18, p. 20*).—The statement is made that "practically all the phosphoric acid in finely ground bone is available." This is not in accord with the conclusions drawn from recent work by Steffek, Märcker, Wagner, and others.

The decomposition of lupines and the economical renovation of exhausted soils, D. VERSTAPPEN (*Ann. Sci. Agron., ser. 2, 2 (1894-'95), No. 3, pp. 349-360*).

The crop-producing value of farmyard manures as compared with commercial fertilizers, S. PEACOCK (*Amer. Fert., 4 (1896), No. 1, pp. 3-7*).—"The points claimed as proved in this paper are not intended to show that farmyard manure is comparatively valueless, but that pound for pound of manurial ingredients chemical manures are more economical." In order to prove these points the author assumes that the barnyard manure actually costs the farmer what its fertilizing constituents are worth if valued on the same basis as commercial fertilizing materials, apparently ignoring the important fact that the manure is as a rule a necessary by-product of the farm and is rarely an article of commerce.

Weight and composition of the leaf mold, etc., of forests, E. HENRY (*Compt. Rend., 122 (1896), No. 3, pp. 144-146*).

Concerning the influence of food upon the bacterial content of cow dung, E. WÜTHRICH and E. VON FREUDENREICH (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 25, pp. 873-879*).

Danger attending the use of town sewage as a manure for pastures, F. CLAES and B. MOENS (*Ann. Sci. Agron., ser. 2, 2 (1894-'95), No. 3, pp. 337-340*).

Lime and gypsum (*Cult. and Country Gent., 1896, Jan. 2, p. 3*).

Burnt lime and marl (*Mitt. deut. landw. Ges., 1896, No. 2, p. 7*).

Comparative tests of the effectiveness of nitrogen in sulphate of ammonia and nitrate of soda, GRAHI (*Mitt. deut. landw. Ges., 1895, No. 7; abs. in Centbl. agr. Chem., 24 (1895) No. 11, p. 781*).—The results during 1893 and 1894 confirmed Wagner's conclusions that ammonium sulphate stands to sodium nitrate as 90 to 100, and indicate that lime is frequently needed to get the best effect.

Field experiments with fertilizers, G. BATTANCHON (*Prog. Agr. et Vit., 25 (1896), No. 6, pp. 150-153*).

Special laws for preventing fraud in fertilizers, feeding stuffs, and seeds, A. PETERMANN (*Ann. Sci. Agron., ser. 2, 2 (1894-'95), No. 2, pp. 277-291*).

The valuation of fertilizers (*Cult. and Country Gent., 1896, Jan. 2, p. 3*).

The consumption of phosphatic slag in the whole world in 1895 (*L'Engrais, 11 (1896), No. 2, p. 38*).—In tons of 1,000 kg. Germany 510,000, England 90,000, Austria-Hungary 37,000, Belgium 50,000, Spain 1,000, France 77,000, Holland 20,000, Italy 30,000, Luxemburg 7,000, Switzerland 10,000, Scandinavia 25,000, Russia 10,000, the Colonies 3,000; total 870,000.

Fertilizers in the United Kingdom, S. PEACOCK (*Amer. Fert., 4 (1896), No. 1, pp. 8-12*).

Analyses of muck, marl, and seaweed, F. T. SHUTT (*Canada Exptl. Farms Rpt. 1894, pp. 158-164*).—Analyses of 18 samples of muck, 5 of marl, and 1 sample of seaweed (*Fucus furcatus*), with notes on the utilization of these materials.

FIELD CROPS.

The permanent effects of manures upon meadow land as shown by the relative abundance of grass and clover in the pasture, and the manner in which it is eaten by stock, A. P. AITKEN (*Trans. Highland and Agl. Soc. Scotland, 1895, pp. 423-432*).—Forty-eight plats were used. In experiments previous to 1894, 28 plats had been manured

with nitrogenous, phosphatic, and potash fertilizers in various combinations, and 1 plat received no manure. On another part of the field 18 twenty-fourth-acre plats were laid out and manured March 23, 1894, with lime, gypsum, slag, sulphate of iron, kainit, and nitrate of soda; 1 plat remained unmanured. Hay had previously been grown on the plats.

"The method of valuation was to affix the value of 100 to a plat on which a completely filled-in sward of grass was growing; also to value at 100 any plat on which clover had taken thick and regular possession of the pasture; and, lastly, to value at 100 any plat which had been eaten down quite bare, and to affix smaller values according as the grasses and clovers were deficient and the herbage uneaten." The plats were visited in the middle of June, the beginning of August, and the middle of September. The percentage valuations are tabulated. White clover was the only kind found on the plats. The land was pastured by cattle and horses.

The reality and value of symbiosis was shown by the fine color and vigor of the grasses on those plats where the clover was thick and by their pale and drooping habit on those where the clover was scarce.

Among the phosphate plats, those to which bone meal had been applied produced good grass and abundant clover, and were among the freshest, greenest, and most closely eaten plats under observation. The stock did not like the grass, though good, on the plats receiving ground mineral phosphate or phosphate. On the plat manured exclusively with phosphate was a uniform sward. of stunted growth. but well eaten.

In the nitrogen section the plat receiving nitrate of soda grew little clover and was avoided by the stock. The plat with sulphate of ammonia had more clover and was better eaten. The plats with horn dust and dried blood were thrifty in appearance and closely eaten. The plat with no nitrogen was fairly well covered, especially with clover, and was well eaten. The plat with nitrate of soda alone grew little grass, almost no clover, and was not touched by the stock until late in the season.

The plat receiving fish guano surpassed those with bone meal, was closely grown with grass and clover, and cropped very short. On the plats with ammonium sulphate and sodium nitrate "the larger the dose of soluble nitrogenous manure the coarser the grass and the less the clover." Where these applications were heavy the soil grew very patchy and tufty grass of a coarse kind.

The plat receiving gypsum was well grown with grass and clover, which were relished by the stock. On the plats manured in 1894 gypsum did better than lime. There was a large proportion of clover on the plat receiving kainit, and the herbage was cropped close. Ferrous sulphate was beneficial when applied with gypsum or slag, but injurious with lime. Nitrate of soda, applied at the end of April, was injurious, especially when used on the plats receiving ferrous sulphate.

Cost of growing fodder crops, J. W. ROBERTSON (*Canada Exptl. Farms Rpt. 1894, pp. 93–101*).—The crops for which detailed statements of cost and yield are given consisted of mixed cereals, roots, corn, horse beans, and sunflowers. The yield of sunflower heads, containing 69.3 per cent of water, was in 1894 about 3½ tons; in 1892 the yield was 7½ tons, and the water content 75.62 per cent. The cost per ton in 1894 was $6.30, including rent of land.

Notes on grasses and forage plants of the Southeastern States, T. H. KEARNEY, Jr. (*U. S. Dept. Agr., Division of Agrostology Bul. 1, pp. 28, figs. 7*).—This treats of forage plants of actual or possible value to the Southeastern States, the several kinds being described, and many of them illustrated. A list is also given of "all the species of Gramineæ collected or seen, arranged according to their natural classification, with observations of purely botanical interest."

In the South the farmer relies for hay mainly on the wild annual grasses which spring up on cultivated land after the crop has been removed, and of which crab grass (*Panicum sanguinale*) is the most important representative; and for pasture on the wild perennials, of which Lousiana grass (*Paspalum platycaule*) is the most widely distributed.

Manuring of lea oats, A. P. AITKEN (*Trans. Highland and Agl. Soc. Scotland, 1895, pp. 115–152*).—There were 2 coöperative experiments. The first was made on 84 plats on 7 farms in Aberdeenshire to test the value of muriate of potash and superphosphate on lea oats, and the advantage of applying the fertilizer before rather than at the time of sowing. The second was to determine the best fertilizer for oats.

In the first experiment 12 twelfth-acre plats were laid out on each farm. On 5 of these plats the fertilizers were applied in winter and on 5 in the spring; 2 served as check plats. Superphosphate 200 lbs. and muriate of potash 100 lbs. per acre were applied singly and in combination with each other, and with sulphate of ammonia 50 lbs. per acre. Owing to the ravages of insects and the heavy and continuous rainfall, but 3 reports were received, and a general summary only is given.

The yields indicated a very slight advantage from superphosphate, little or none from muriate of potash, but a considerable increase from the sulphate of ammonia. The general result indicated that on some soils and under some circumstances the application of superphosphate and potash may advantageously take place in winter, and that even sulphate of ammonia may be applied with advantage some weeks before sowing.

The second experiment was made on 51 eighth-acre plats on 4 farms. The soil is described as in poor condition except on 1 farm, where it was fairly good. Superphosphate 300 lbs., muriate of potash 150 lbs., common salt 300 lbs., and nitrate of soda 100 or 150 lbs. per acre were applied to the plats singly and combined with each other, and with a

mixture of nitrate of soda and sulphate of ammonia, 150 lbs. per acre. On 3 plats sulphate of ammonia was used instead of nitrate of soda.

In this experiment the author concludes in general that the yields were better where the nitrate of soda was applied after the oats were up than when the seed was sown. The yields from the mixture of nitrate of soda and sulphate of ammonia were less than the average on the other fertilized plats. There was a considerable increase both in grain and straw on the plats to which common salt was applied, and the grain did not lodge. The grain lodged worst on the nitrate of soda plats, and the addition of muriate of potash failed to prevent this. The lightest grain grew on the unmanured check plats: the next on the plat with nitrate of soda applied after the grain was up. The grain weighed a trifle less per bushel on the plats to which sulphate of ammonia was applied instead of nitrate of soda, but the yields were greater than on any of the other plats.

Experiments with potatoes, E. S. GOFF (*Wisconsin Sta. Rpt. 1893, pp. 262-264*).—A summary of the results of experiments in potato culture obtained at the station since its organization. Taken as a whole these results favored heavy seeding and the retention of the seed end. No loss in yield followed planting in hills rather than in drills.

Sugar beets in Iowa, G. E. PATRICK (*Iowa Sta. Bul. 28, pp. 180-198*).—The results of analyses of 16 samples of beets grown in different portions of the State in 1894 are tabulated and discussed, and the results of 4 seasons' work with sugar beets are reviewed. Of 614 samples grown during 4 years 41 per cent contained over 12 per cent of sugar and had a purity coëfficient of 75 or upward. The effect of soils of different character on the sugar content and purity of sugar beets is discussed, and the author's conclusion is that in Iowa the best soils for this plant are those described as clays and clay loams.

Fertilizer experiments on tobacco, N. PASSERINI (*Staz. Sper. Agr. Ital., 28 (1895), No. 8, pp. 513-529, fig. 1*).—These experiments were conducted on 24 plats on a soil containing in the chemically dry material 0.1475 per cent of nitrogen, 0.3159 per cent of phosphoric acid, and 0.6675 per cent of potash. The dryness of the summer and the fertility of the soil somewhat obscured the results. Under these conditions the greatest weight of air-dry leaves was obtained by the use of nitrogenous and complete fertilizers. Certain fertilizers improved the combustibility of tobacco as shown by a burning test, and notably increased the content of carbonate of potash in the ash. But in no case was there more than 5.1849 per cent of carbonate of potash in the ash of the leaves, while in the ash of cigars found on the market there was from 9 to 19 per cent. The author suggests the probability that the variety used, "Seed leaf," may be deficient in the ability to take up potash salts. The fertilizers which especially increased the combustibility of tobacco leaves were peat, especially in combination with urine, and sulphate and carbonate of potash.

The percentages of nicotin in chemically dry tobacco leaves from certain plats are reported as follows: Unfertilized, 3.4074 per cent; with 580 lbs. dried blood per acre, 2.5329 per cent; with 267 lbs. sulphate of ammonia, 1.6724 per cent; and with 356 lbs. nitrate of soda, 4.1833 per cent.

The apparatus used in the burning test is figured.

Finely ground phosphates as a turnip manure, A. P. AITKEN (*Trans. Highland and Agl. Soc. Scotland, 1895, pp. 152–157*).—This is a coöperative experiment on 37 farms to compare on turnips the relative efficiency of a number of natural phosphates of the same degree of fineness, *i. e.*, passing a sieve with 10,000 holes per square inch. The quantity applied to each plat was such as to supply phosphoric acid at the rate of 100 lbs. per acre. In addition, muriate of potash and sulphate of ammonia were applied at the rate of 50 lbs. per acre. One-half the plats was manured in February and the other half at the time of sowing. Analyses of the phosphates are given. On account of a rainy season and the ravages of club root, the results of only 11 trials are tabulated.

Yields of turnips with finely ground phosphates.

	Yields per acre with			
	Fertilizer applied in February		Fertilizer applied in April	
	Tons	*Cwt*	*Tons*	*Cwt*
Superphosphate	17	2	17	11
Slag	16	16	16	4
Carolina (Charleston)	15	0	15	0
Phosphatic guano	14	14	15	5
Algerian	14	4	15	7
Belgian	13	18	14	10
Florida Peace River	13	9	14	8
Florida Rock	11	18	12	14
Average	14	13	15	2

The author concludes "that the kind of phosphate as distinct from mere fineness of grinding is of some importance." There was small difference in the efficacy of the fertilizers whether applied in February or in April.

The economical manuring of the turnip crop, A. P. AITKEN (*Trans. Highland and Agl. Soc. Scotland, 1895, pp. 136–142*).—Fine bone meal, superphosphate, and Thomas slag, in quantities from 4 to 9 cwt. per acre, and nitrate of soda and sulphate of ammonia from 20 to 200 lbs. per acre, were used in varying proportions and combinations in 78 coöperative field experiments in Banffshire in 1894, 37 with barnyard manure and 41 without. Where barnyard manure was used only one-half as much commercial fertilizers was applied as where the latter was used exclusively. Forty three farmers conducted the experiments in 5 districts in Banffshire. The rainfall was so abundant and continuous that the yields were very meager and inconclusive, and a summary only of 38 experiments is given.

On the soil to which commercial fertilizers only were applied the yields with superphosphate and with slag were better than with bone meal. With sulphate of ammonia the yields were better than with nitrate of soda. On the soil to which barnyard manure and commercial fertilizers were applied the yields were no greater than when the latter were used exclusively.

Results of three years' experiments in cost and profit of growing wheat, B. C. BUFFUM (*Wyoming Sta. Bul. 25, pp. 147–154*).—Tabulated data are given for 3 years' work in growing wheat on single acres on irrigated and unirrigated land at 6 substations in the State. The cost per acre of preparation and sowing varied from \$2.43 to \$5; of irrigation from \$0.88 to \$4; of harvesting from \$1.60 to \$3.50; of threshing from \$1.50 to \$3.60 (4.6 to 10 cts. per bushel). The yield varied from 20 to 59 bu. per acre. The following table gives the average for the substations:

Average cost and profit of growing wheat in Wyoming.

Substation	Years.	Yield per acre		Value per acre.	Cost per acre.	Profit per acre
		Pounds	Bushels			
Laramie	1894, 1895	1,904	31.7	\$19.03	\$10.15	\$8.88
Lander	1893–1895	1,580	26.5	19.95	10.78	9.17
Saratoga	1894	2,410	40.2	24.00	7.30	16.70
Sheridan	1893–1895	2,521	42.0	22.25	12.10	10.15
Sundance	1893–1895	1,293	21.5	15.93	9.02	6.91
Wheatland	1893–1895	2,147	35.8	22.07	12.93	9.14
Average		1,976	32.9	20.54	10.38	10.16

The author concludes that—

"Advantages of raising wheat under irrigation are (1) an assured crop, (2) larger yields, (3) heavier and better grain, (4) maintaining fertility of the soil.

"The cost of raising wheat varies from \$7.30 to \$13.36 per acre. Estimated cost upon 40 acres or more by the use of improved machinery was \$7.75 per acre.

"Profit varies from \$1.73 to \$16.70 per acre.

"Average profit is \$10.16 per acre."

Field experiments with fertilizers in Great Britain, T. WINTER, W. SOMERVILLE, J. A. MURRAY, D. A. GILCHRIST, and R. P. WRIGHT (*Bd. Agr. Rpt. Distrib. Grants for Agl. Education in Great Britain, 1894–'95, pp. 41–62, 66–78, 96–101*).—The majority of these consisted of fertilizer experiments on pastures, meadows, swedes (ruta-bagas), wheat, oats, and barley. The tests were conducted on farms in England, Scotland, and Wales, and were of local rather than general interest.

On ruta bagas in Wales and in Northumberland, England, superphosphates afforded a larger yield than basic slag, except when the soil was notably deficient in lime. The time at which nitrate of soda was applied to ruta-bagas did not greatly affect the yield. In one case salt apparently exercised a favorable influence on this crop. In several instances a comparison was made between nitrate of soda and sulphate of ammonia, but the results varied with the locality, the season, and

the crop. In one experiment on grass land it was found that "when phosphatic and nitrogenous manures are used together the best results are obtained where the more slowly acting phosphatic manures are used along with the less readily soluble nitrogenous manures. Bone meal and dissolved bone do better with sulphate of ammonia than with nitrate of soda." Nitrogenous manures, especially nitrate of soda, except when in combination with phosphates, reduced the quality of the hay crop while increasing the quantity.

In experiments on meadows in Scotland a complete fertilizer gave more satisfactory results than any other artificial fertilizer, but the greatest profit was secured by the use of barnyard manure, supplemented by nitrate of soda. Potash was generally beneficial and increased the proportion of clover. Salt, though killing some shallow-rooted weeds, gave, as a rule, unprofitable results. On clover its effects were distinctly injurious. Likewise on clover, kainit, probably on account of the salt contained in it, was less beneficial than muriate of potash.

Experiments, preliminary, practical, and miscellaneous, made in 1894, with general conclusions from three years' experiments, P. DE VUYST (*Cultures Speciales Expériences de Borsbeke-lez-Alost, 1894, p. 61*).—Fertilizer tests are given with potatoes, stock beets, carrots and parsnips, turnips, winter wheat, rye, oats, clover, and flax; the effect of manures on meadows; comparison of different phosphates; comparison of excelsior and straw for bedding; and experiments in electro-culture. Variety tests are given with potatoes, stock beets, winter wheat, and oats; and distance trials with potatoes and stock beets.

Field experiments with small grains and roots, W. SAUNDERS (*Canada Exptl. Farms Rpt. 1894, pp. 10–36*).—Among the experiments conducted in 1894 were variety tests of peas and sugar beets and variety and fertilizer tests of oats, barley, wheat, corn, turnips, mangel-wurzels, carrots, sugar beets, peas, and potatoes.

In a comparison of 15 tons of rotted barnyard manure with the same weight of fresh manure, the larger yield was obtained by using fresh manure on wheat, barley, oats, and turnips; mangel wurzels and sugar beets afforded a larger yield with rotted manure; and with corn, carrots, and potatoes the results were contradictory.

Farm crops at the experimental farm at Nappan, Nova Scotia, W. M. BLAIR (*Canada Exptl. Farms Rpt. 1894, pp. 253–266*).—Among these were variety tests of wheat, barley, oats, peas, turnips, carrots, mangel-wurzels, sugar beets, potatoes, and corn. Silver Hull buckwheat yielded more when sown at the rate of ½ bu. of seed per acre than when 1½ or 2 bu. of seed was used. Experiments to determine the date for sowing oats, barley, and spring wheat, amount of seed potatoes, and value of various mixtures of grain crops were made.

Farm crops at the experimental farm at Brandon, Manitoba, S. A. BEDFORD (*Canada Exptl. Farms Rpt. 1894, pp. 281–306*).—Among

the experiments conducted were variety tests of wheat, oats, barley, peas, grasses, millet, turnips, mangel-wurzels, and sugar beets. Rolling wheat proved advantageous. Wheat cut in the dough stage or 1 week before perfectly ripe yielded almost as much as when allowed to ripen thoroughly, but cutting before the dough stage was reached greatly reduced the yield. The results of experiments for determining the best dates for sowing wheat, oats, barley, and flax; methods of preparing land for wheat; and a fertilizer experiment on barley are tabulated. Drilled wheat yielded more than that sown broadcast. In a test of 15 varieties of 6-rowed barley, Excelsior, a beardless variety, afforded the largest yield.

The yield of flaxseed was practically identical whether 90, 70, or 40 lbs. of seed per acre was used. Twenty-three pounds of millet seed per acre afforded a larger yield both of hay and of grain than was obtained when 46 lbs. of seed was used.

Sunflowers planted at distances of 3 by 1 ft. yielded 13,200 lbs. per acre of ripe heads. With all roots tested early sowing proved advantageous.

Farm crops at the experimental farm, Indian Head, Northwest Provinces, A. MACKAY (*Canada Exptl. Farms Rpt. 1894, pp. 333-356*).—The season of 1894 was dry and unfavorable. Spring wheat and oats during several years averaged more when sown with a press drill than with an ordinary drill; with wheat both methods afforded larger yields than sowing broadcast. In a single test with barley the use of the ordinary drill was followed by a larger yield than when the press drill was employed. Cross drilling did not increase the yield of wheat and oats. The average results for 3 years favored sowing 1 bu. of wheat per acre rather than 5 or 6 pecks. Seven pecks of barley afforded a larger yield than 5 pecks; 2 bu. of oats more than 2½ bu.

In the dry season of 1894 wheat planted at a depth of 3 in. yielded more than when planted 1 or 2 in. deep; the average results for 3 years favored a depth of 2 in. Bare fallowing was found to be the best method of preparing land for wheat, barley, and oats.

Of 16 grasses sown in 1892, *Bromus inermis* was the only one that survived.

Among other experiments conducted were variety tests of wheat, barley, oats, peas, corn, turnips, mangel wurzels, carrots, sugar beets, and potatoes, and tests of the time of sowing small grains.

Culture of the cereals in Algeria, H. VAGNON (*Bul. Agr. Alger. et Tunisie, 1 (1895), No. 6, pp. 120-128*).

Experiments to establish the cultural value of different varieties of grains, III, F. HEINE and N. WESTERMEIER (*Deut. landw. Presse, 23 (1895), No. 10, pp. 79, 80*).

New fodder plants, E. QUOSTHOFF (*Deut. landw. Presse, 23 (1895), No. 10, p. 77, figs. 2*).—*Vicia dumentorum* is tender and juicy and is a favorite with cattle. It has great tillering capacity and leaves no vacant spaces, and does not lodge. It is better suited for sowing alone than for mixed seeding. *Vicia silvatica* is also tender and liked by cattle. It is better in mixed seeding than when raised for fodder.

Notes on Pennisetum orientale (*Roy. Bot. Gard. Trinidad Bul., 2 (1896), No. 5, p. 109*).—Notes are given on this grass, which is said to be very promising for hillside and valley cultivation.

Growing rape seed, T. SHAW (*Breeders' Gaz., 29 (1896), No. 9, p. 145*).—The climate of the Northern States is too cold to grow the seed. It can probably be raised in the South, but this must be tested by experiment.

Sulla. and its value as a forage plant and green manure, L. GRANDEAU (*Ann. Sci. Agron., ser. 2, 2 (1894–'95), No. 3, pp. 474–483*).

Sulla, J. KNILL (*Bul. Agr. Alger. et Tunisie, 1 (1895), Nos. 13, pp. 303–312; 14, pp. 327–334; 17, pp. 397–402; 18, pp. 424–432*).

Test of varieties of sugar cane, J. H. WAKKER (*East Java Expt. Sta. Bul. No. 19, pp. 24*).—Four hundred and thirteen determinations of sugar, glucose, etc., in a large number of varieties of sugar cane.

New cane varieties and new diseases, H. TRYON (*Hawaiian Planters' Monthly, 14 (1895), No. 10, pp. 449–459*).

Experiments with wheat and oats at Grignon in 1895, P. P. DEHÉRAIN (*Ann. Agron., 21 (1895), No. 12, pp. 545–565*).

Cultural experiments on the academic trial field at Poppelsdorf, F. W. WOHLTMANN (*Ztschr. landw. Ver. Rheinpreussen, 12 (1895), Nos. 50, pp. 402, 403; 51, pp. 416, 417*).

Experiments in sugar-beet culture 1883-'93, F. W. WOLL (*Wisconsin Sta. Rpt. 1893, pp. 284, 285*).—Abstract of reports of investigations of sugar-beet culture in Wisconsin previously published by the station (E. S. R., 2, p. 671; 5, p. 491).

Field crops at the experimental farm at Agassiz, British Columbia, T. A. SHARPE (*Canada Exptl. Farms Rpt. 1894, pp. 387–399*).—Among the experiments conducted in 1894 were variety tests of fall wheat, spring wheat, barley, oats, peas, turnips, mangel-wurzels, carrots, corn, and potatoes; and experiments to determine the best time for sowing oats, barley, and wheat.

Miscellaneous agricultural topics (*North Carolina Sta. Bul. 115, pp. 163–180, fig. 1*).—Reprints of press bulletins of the station, some of the principal topics treated being crimson clover in 1891, army worms, bones as fertilizers, "hollow horn" and "hollow tail," keeping sweet potatoes, bees and bee worms, value of one day's cow rations as a fertilizer, destroying wild onions, mixing fertilizers at home, ox warble or heel fly, cotton-seed feed, and feeding cotton-seed products.

HORTICULTURE.

Manuring of beans, A. P. AITKEN (*Trans. Highland and Agl. Soc. Scotland, 1895, pp. 112–141*).—This is a coöperative experiment extending over 2 years on 10 farms in Stirlingshire, in which superphosphates, muriate of potash, kainit, gypsum, and sulphate of iron were applied in varying proportions and combinations to soil on which beans were grown. Barnyard manure was also used. Owing to an unusually wet season and other reasons the results of only 5 experiments were tabulated. The author concludes that as good crops of beans can be grown with commercial fertilizers as with barnyard manure, and that there were no marked differences due to any one kind of manure over another. The yields with kainit and muriate of potash were equally good. The indications were that sulphate of iron was sometimes beneficial, sometimes injurious, and sometimes produced no effect.

Researches on citrus fruits, V. OLIVIERI and F. GUERRIERI (*Staz. Sper. Agr. Ital., 28 (1895), No. 5, pp. 287-301*).—This consists of 20 tables, showing the results of numerous chemical analyses of oranges, mandarins, and lemons, the peel, pulp, juice, seeds, foliage, green wood, and dry wood being separately analyzed. The technique of analysis is given in some detail. Based on these analyses, which show much variation in the composition of the fruits investigated, the following fertilizer is recommended for citrus fruits in general in the province of Palermo: Muriate of potash 900 gm., Thomas slag 1,000 gm., and sulphate of ammonia 3,530 gm. for each tree.

Second report on the sand cherry as a stock, J. L. BUDD and N. E. HANSEN (*Iowa Sta. Bul. 28, pp 229-233*).—A progress report on investigations as to the value of the sand cherry as a stock for both budding and grafting, it being believed that the hardiness and thriftiness of this species will prove advantageous to orchardists in that part of the country. Notes are given on the results of crown grafting and budding with both native and imported plums and cherries.

The following is the summary of the authors:

"The experience of 2 years with the sand cherry indicates that it is a promising stock for the Japanese and native plums. Budding gives larger, smoother, stockier trees in nursery than grafting. The European plums are more dwarfed than by native plum stocks, and will probably bear younger than on plum stocks if not permitted to root from the scion.

"The cultivated cherries do not appear to unite readily with the sand cherry either by budding or grafting. Yet it may be that we have not worked them at the proper time.

"The sand cherry stock hastens the blossoming of the Japanese and native plums. Scattered experience in Utah, Georgia, Iowa, and elsewhere indicates that the cultivated plums bear earlier on this stock than on plum stocks.

"The early and heavy bearing of the sand cherry from northwest Nebraska has special interest, as plants on the college grounds from Colorado have blossomed freely during the past 12 years, but have rarely borne a specimen of fruit. All our stocks on which the buds and grafts failed are bending under their loads of fruit when 2 years old."

On the composition of different kinds of berries, A. EINECKE (*Landw. Vers. Stat., 46, No. 1, pp. 21, 22*).—The object was to determine whether there are differences in the composition of varieties of gooseberries and currants; and, if so, whether these differences are characteristic of the varieties or are due to favorable conditions of culture, manuring, season, etc. Analyses are tabulated for 6 varieties of gooseberries and 5 of currants. The work is to be continued for several seasons.

Fruits (*Canada Exptl. Farms Rpt. 1894, pp. 122-146, figs. 2*).—A collection of notes and tabulated data on various orchard and small fruits grown at the experimental farms. A table is given showing the effect of the winters from 1890 to 1894 on a standard apple orchard, the majority of varieties being more or less injured. Ten newer varieties of American and Russian apples are described and compared. Among the cherries experiments were made with some Russian varieties and the sand cherry. The

latter was found to be hardy and has been distributed throughout the province to be tested further by various fruit growers. Seven varieties of plums are described and compared, 2 of them, Early Red and Moldavka, Russian varieties, being considered of especial value. Notes are also given on crab apples, grapes, raspberries, and strawberries. A table shows the yield and thriftiness of foliage of 88 varieties of strawberries. In a comparative test of 25 varieties of strawberries, Crescent led, giving a yield of 40 boxes from a 60-foot row. A list of the fruits received for examination is appended and mention is made of the distribution of poplar and willow cuttings, asparagus, rhubarb, apple, and crab apple seeds, and plants and scions of new fruit.

Fruit culture in Malaga, D. N. BURKE (*U. S. Consular Rpt. 1895, Aug., pp. 564–569*).—This consists of information obtained from native fruit growers on the culture of grapes and raisins, oranges, and lemons. The vineyard acreage is stated to have diminished in the past quarter of a century from some 261,000 acres to only about 60,000 acres that are free from the phylloxera or disease. American vines of *Vitis riparia* stock are being used in place of the European vines on account of resisting the phylloxera, but will not flourish in calcareous or slaty soil or hilly locations. The muscatel grapes are preferred for raisins, and furnish from 33 to 40 per cent of prepared product. Both grapes and raisins are exported to the United States.

The chief varieties of oranges grown are the China Dulce, China Agria, Grano de Oro, and Caña Dulce, the first two being those chiefly exported, and little of the fruit coming to the United States.

Two types of lemons are exported to the United States, the "Reales," or elliptical, and "Castallanos," or round lemons. There were 41,766 boxes sent to this country in 1894. The method of curing and packing is briefly described.

Food requirements of the chrysanthemum, M. P. ANDERSON (*Gard. Chron., 3d ser., 18 (1895), No. 461, pp. 186, 187*).—A controversial article on the merits of different mixtures of fertilizers for chrysanthemums, the writer comparing the fertilizers compounded by himself with those advocated by others, and giving a table showing the differences between the composition of chrysanthemum ash and of the various fertilizers. The composition of the ash is given as potash 16¼ per cent, soda 10¼, lime 26¼, magnesia 10¼, phosphoric acid 19½, sulphuric acid 4½, iron 3½, chlorin 3, silica 5¾, and nitrogen (in the fresh plant) 3. The fertilizing mixture recommended consists of kainit 3 parts, basic slag 3, sulphate of ammonia 1, and phosphate of potash 1, applied at the rate of 1 part to 400 in weight of soil.

Miscellaneous horticultural and botanical work (*Wisconsin Sta. Rpt. 1893, pp. 265–271, pls. 3, figs. 5*).—Brief remarks on some investigations carried on at the station. A breeding experiment with tomatoes that has been in progress for 6 years is reported upon. Two strains of tomatoes have been compared for the last 6 generations, one of the

strains being grown from entirely mature fruits, while the other strain of the same variety has been grown the same length of time from fruits so immature that they had not commenced to change color toward ripeness. Illustrations are given showing the effect on the foliage and fruit production, the plants from mature seed having more erect and luxuriant foliage, while the plants from immature seed gave an earlier and greater yield of fruit. Diagrams are given indicating the difference between the strains in regard to the points of foliage and fruit.

The comparative vitality of hulled and unhulled timothy seed is briefly noted, experiments showing that unhulled seed germinates better and retains its vitality longer, being reliable at 5 years of age, though rapidly deteriorating after that time.

A brief note is given on grape growing at the station, fruiting vines of the Delaware and Worden varieties and the process of covering grapevines for winter protection being illustrated from photographs. Close pruning and training to single posts are practiced.

Observations made in previous years as to the times of the bursting of leaf buds and successive stages of growth of various common trees and shrubs are briefly corroborated, and notes made upon the fall of leaves in the autumn, 3 periods being designated, the second of which comprises the main defoliation. Several species, as willows, cottonwood, and white elm, are noted as casting off weakened twigs in the autumn.

Horticultural investigations from a botanical standpoint, L. H. PAMMEL (*Monthly Weather Rev. Iowa Weather and Crop Service, 6 (1895), No. 12, pp. 6, 7*).—Brief popular article.

Does asparagus need salt? (*Rural New Yorker, 1896, Jan. 18, p. 34*).—A number of prominent horticulturists give their opinions on this subject, the consensus of which seems to be that asparagus does not need salt and is not benefited by it materially. Large applications do not injure it, however, and may serve to keep down weeds.

Broad beans (*Amer. Gard., 17 (1896), No. 57, p. 50*).—Brief cultural notes on the English broad beans.

Cauliflowers (*Jour. Hort., 1896, No. 2467, pp. 23, 24*).—Directions for the early spring growing of cauliflowers in England, the plants being started under glass.

Chicory (*Jour. Hort., 1896, No. 2466, p. 12*).—Brief note on winter culture under glass for salads.

Cyperus (*Jour. Hort., 1896, No. 2469, p. 76*).—Brief cultural notes.

Hops and hop growing in California (*California Fruit Grower, 18 (1896), No. 4, p. 61, fig. 1*).—A brief note on the industry, with illustration of drying kilns and warehouses.

The onion and its cultivation, W. W. GLENNY (*Jour. Roy. Agl. Soc. England, 6 (1895), No. 22, pp. 257–275, figs. 6*).—A popular article on the subject, giving the history of this vegetable, directions for its cultivation and marketing, treatment of diseases and insects, statistics of the yield in different countries, and recommendations for the more extensive growing of leeks, chives, garlic, and onions in England.

Training tomatoes, G. A. WOOLSON (*Garden and Forest, 9 (1896), No. 416, pp. 67, 68*).—Brief notes on the use of wire netting as trellises.

Cultivation of the tomato, W. W. TRACY (*Garden and Forest, 9 (1896), No. 413,*

p. 37).—General discussion and directions, with special attention to temperature, moisture, and tillage.

New and old favorite vegetables (*Gard. Chron., 19 (1896), No. 475, pp. 136, 137*).—Brief notes on some English and continental varieties.

Green stuff for winter, T. GREINER (*Amer. Gard., 17 (1896), No. 57, p. 51, figs. 2*).—Illustrated notes on the winter growing of salad chicory, the plants to be taken up in the fall, the tops and roots trimmed, and then reset in boxes and covered with several inches of fine, loose, moist earth. After a few weeks the plants will be found to have developed a crisp growth of new, blanched foliage, which can be cut off and eaten as a salad, or as a substitute for asparagus. If the tops be covered again with earth a second crop will result.

A contribution to the improvement of vegetable culture, K. WOZELKA (*Deut. landw. Presse, 22 (1895), No. 102, pp. 926, 927, figs. 4*).

Hotbeds and their uses (*Jour. Hort., 1896, No. 2468, p. 50*).—Brief popular directions for construction and uses.

Greenhouse heating (*Amer. Gard., 17 (1896), No. 57, pp. 51, 52*).—An abstract of a lecture by L. H. Bailey, giving a historical sketch of the subject.

Greenhouse heating (*Amer. Gard., 17 (1896), No. 58, p. 72*).—An article comparing the value of steam and hot water for this purpose, the two systems being shown to possess about equal value, although steam is generally preferred.

The chemistry of the apple and the strawberry, F. T. SHUTT (*Canada Exptl. Farms. Rpt. 1894, pp. 164-171*).—A reprint of analyses (with reference to fertilizing constituents) of leaves, previously printed in report of this institution for 1890 (E. S. R., 3, p. 357), with the addition of similar analyses of the fruit of the same 4 varieties. Analyses with reference to fertilizing constituents are also reported for plants of 4 varieties of strawberries collected in bloom. In each case the draft of the plants on the soil is calculated and discussed.

Uses of bananas and plantains, L. A. BERNAYS (*Hawaiian Planters' Monthly, 14 (1895), No. 10, pp. 467-472*).—A popular article quoted from *Mackay Sugar Journal.*

The cherimoyer, E. D. STURTEVANT (*Garden and Forest, 9 (1896), No. 415, p. 57*).—Brief notes on the growing of this fruit near Los Angeles.

On the composition of the citrus fruits, L. DANESI and C. BOSCHI (*Staz. Sper. Agr. Ital., 28 (1895), No. 11, pp. 699-707*).

On the cultivation of the lemon, C. BOSCHI (*Staz. Sper. Agr. Ital., 28 (1895), No. 11, pp. 708-719*).

California oranges and the frost, W. M. TISDALE (*Garden and Forest, 9 (1896), No. 415, pp. 56, 57*).—States that the damage done has been overestimated, as only 5 to 10 per cent of the orchards have been destroyed, and only 20 to 30 per cent injured. The chief injury was in the low country about Riverside.

Pruning peaches, T. GREINER (*Amer. Gard., 17 (1896), No. 59, p. 83, figs. 2*).—An abstract of an article by J. H. Hale in U. S. Dept. Agr., Rpt. Pomologist, 1894.

Orchard irrigation for fall and winter, F. CROWLEY (*Amer. Hort., 6 (1896), No. 1, p. 7*).—Advises early checking of the water in autumn, to allow the wood to ripen, to be followed by a thorough soaking just before winter, and one during the winter if the weather be dry.

Alfalfa or clover as a food for the orchard, F. L. WATROUS (*Amer. Agr., 1896, Jan. 18, p. 60*).

The double grafting of pears (*Garden, 49 (1896), No. 1263, p. 73*).—Notes on the practice in England.

Protecting young fruit trees, J. TROOP (*Amer. Hort., 6 (1896), No. 1, p. 4*).—A short article, advising the mounding up of earth about the lower trunks of young fruit trees, or surrounding the trunks with woven wire or sheathing paper, to prevent injury by rabbits and mice.

Cultivation of the dewberry (*Garden and Forest, 9 (1896), No. 416, p. 68*).—Abstract of a paper read by J. A. Wilcox before the Western New York Horticultural Society.

The fourth year's observations on the effect of land plaster on grapes, G. BATTANCHON (*Prog. Agr. et Vit., 12 (1895), No. 47, pp. 544–546*).

Fruit forcing—vines (*Jour. Hort., 1896, No. 2466, p. 18*).—Brief directions in regard to fertilizing, pinching, temperature, and moisture.

Propagating vines, E. MOLYNEUX (*Jour. Hort., 1896, No. 2468, p. 50*).—Brief directions on the subject.

Resistant vines (*California Fruit Grower, 18 (1896), No. 6, p. 109*).—A table from French sources, showing the power of resistance to phylloxera possessed by various species and varieties of grapes, chiefly European. Those of *Vitis vinifera* origin fall easy victims, while *V. riparia* and *V. rupestris* varieties are but little affected, and the Scuppernong (*V. rotundifolia*) not at all.

Exhausted vines, W. W. CHAPMAN (*Jour. Hort., 1896, No. 2470, pp. 90, 91*).—Notes on the renovation of old vines in an English grape house by means of placing fresh soil about the roots.

Cultivation of cocoanut (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895), No. 9, pp. 182, 183*).

Cultivation of the cocoa (*Bul. Bot. Dept. Jamaica, n. ser., 2 (1895), No. 9, pp. 180, 181*).

Some observations regarding kola nuts, A. R. L. DOHME and H. ENGELHARDT (*Amer. Jour. Pharm., 68 (1896), No. 1, pp. 5–7*).

Amaryllis culture, E. O. ORPET (*Garden and Forest, 9 (1896), No. 416, pp. 65, 66*).—A popular cultural article.

Winter-flowering begonias, T. D. HATFIELD (*Garden and Forest, 9 (1896), No. 413, pp. 37, 38*).—Descriptive and cultural notes on several varieties.

Carnation notes, F. DORNER (*Amer. Florist, 11 (1896), No. 191, p. 700*).—Brief notes on the best methods of producing high-grade flowers, well-manured clay soil being preferred.

Notes on geraniums (*Canada Exptl. Farms Rpt. 1891, pp. 54–58*).—Comparative descriptive notes on 59 varieties of geraniums, with a recommendation of varieties preferable for that section of the country.

Cultural notes on orchids, E. O. ORPET (*Garden and Forest, 9 (1896), No. 411, pp. 45, 46*).—General remarks on the subject, soil, moss, watering, and temperature being discussed.

The pepper tree for house culture, B. L. PUTNAM (*Garden and Forest, 9 (1896), No. 413, p. 38*).—Advises this as a window plant, with frequent sprinkling to induce flowering.

Forcing hybrid perpetual roses, W. SCOTT (*Garden and Forest, 9 (1896), No. 415, p. 55*).—Brief cultural notes.

Rose notes, R. SIMPSON (*Amer. Florist, 11 (1896), No. 191, pp. 700–702*).—Directions for grafting roses.

Perfumes from flowers, (*Amer. Gard., 17 (1896), No. 59, p. 85*).—Brief note on methods used in France.

Propagation from slips, E. A. LONG (*Amer. Gard., 17 (1896), No. 59, p. 85, fig. 1*).—Illustrated directions for multiplying various house and bedding plants.

A choice selection of hardy ornamental shrubs (*Canada Exptl. Farms Rpt. 1894, pp. 42–50, figs. 10*).—Illustrated and descriptive notes on 12 species or varieties of ornamental shrubs being tested on the Central Experimental Farm. In addition brief remarks are made on the forest belts and clumps that have been set out, Russian poplars and willows being especially noticed.

Hardy garden plants, E. O. ORPET (*Florist's Exchange, 8 (1896), No. 3, pp. 46, 47*).—Recommends hardy flowering plants, especially of the Liliaceæ, for New England gardens.

Shrubbery in winter (*Garden and Forest, 9 (1896), No. 414, p. 41*).—Brief suggestive notes, especially recommending deciduous shrubs with attractively colored barks, as willows, viburnums, and dogwoods.

Flowers and fruits at the Northwest Territory experimental farm, A. MACKAY (*Canada Exptl. Farms Rpt. 1894, pp. 364–372*).—Notes on various annual and perennial flowering plants grown at the farm, and a report on various orchard and small fruits, many of which suffered from the severe winter weather.

Fruit culture sixty years ago (*Jour. Hort., 1896, No. 2468, pp. 49, 50*).—A short popular article on the former condition of fruit growing in England.

Temperatures showing liability of damage from frost (*California Fruit Grower, 18 (1896), No. 6, p. 113*).—A table compiled from information received from horticulturists on the Pacific slope, showing the lowest temperatures various fruits and vegetables will endure at different stages of growth without injury.

Horticulture in eastern Nebraska, E. T. HARTLEY (*Garden and Forest, 9 (1896), No. 415, p. 58*).—A brief abstract of a paper read before the Nebraska State Horticultural Society. Cultivation is advised instead of much irrigation.

Report of the horticulturist, J. CRAIG (*Canada Exptl. Farms Rpt. 1894, pp. 103–107*).—Report on the work of the horticultural department during the year, investigations being undertaken in cold storage, growing tobacco, and treatment of fungus diseases.

Horticulture in the maritime provinces, W. M. BLAIR (*Canada Exptl. Farms Rpt. 1894, pp. 267–280*).—A report on the vegetables, fruits, flowers, and ornamental trees and shrubs grown during the season in Nova Scotia, with brief mention of the meetings of farmers for the discussion of agricultural subjects.

Fruits and vegetables at British Columbia experimental farm, T. A. SHARPE (*Canada Exptl. Farms Rpt. 1894, pp. 399–411, pls. 3*).—Notes on various orchard and small fruits and vegetables grown at this farm, with engravings of a hop vine, plum tree, and blackberry. Descriptive notes are given for a number of varieties of fruits and tabulated data for several varieties of vegetables.

Vegetables at the Northwest Territory experimental farm, A. MACKAY (*Canada Exptl. Farms Rpt. 1894, pp. 359–364*).—Tabulated data on a variety test of various vegetables, most of which thrived well.

Horticulture at the Manitoba experimental farm, S. A. BEDFORD (*Canada Exptl. Farms Rpt. 1894, pp. 309–329*).—This includes notes on orchard and small fruits, vegetables, and flowers, with brief mention of experiments with hedge plants, and shelter belts on the farm. Descriptive notes and tabulated data are given for several varieties of each kind of vegetable.

SEEDS—WEEDS.

Tests of grain and other seeds, W. SAUNDERS (*Canada Exptl. Farms Rpt. 1894, pp. 22–24, fig. 1*).—During the past year there were tested 2,157 samples of seed of all kinds, those of wheat, barley, oats, and peas far exceeding all others. As compared with the tests of the previous year, there was a decided improvement in the vitality of the seed examined. The average of the wheat showed an increase of 8.7 per cent in its vitality, oats 2.5, barley 4.1, and peas 3.8 per cent. Tables are given showing the results of testing seed for vitality in 1894, and the results of the tests of wheat, barley, and oats for the different provinces during the same year.

Second report of the seed-control department of the Hamburg Commercial Botanical Museum and Laboratory, A. VOIGT (*1895, pp. 10*).—A report is given of the seed testing for the year ending June 30, 1894. There were examined 627 separate lots of seed during the year, requiring 764 individual experiments. The leading varieties of

seed sent in for examination were red, white, and Swedish clover, lucern, serradella, sesame, and orchard grass. Of the individual tests 391 were examinations for dodder, 110 for purity, and 119 for germinative ability. Of the samples of red clover seed examined 48.1 per cent were found to contain dodder seed in varying amounts, an increase of 7 per cent over the previous year. It was found that nearly all the leading seed which was examined for purity and germinative ability gave a higher average than that obtained the previous year, a marked improvement being shown for red, white, and Swedish clover.

In the previous year's report, in addition to the mention of the year's investigations, a scale of prices charged for making examinations, the size of the sample needed, and time required for conducting the tests are given.

Poisoning from cowbane (Cicuta maculata), L. H. PAMMEL (*Iowa Sta. Bul. 28, pp. 215–225, figs. 7*).—A description is given of this weed, and some of the most striking characteristics are pointed out. Numerous instances are cited of fatal poisoning following the eating of its roots. The roots, at least when fresh, seem especially poisonous to men and cattle, while horses, sheep, pigs, etc., are said not to be seriously affected by them. The active principle of the cowbane, or water hemlock, according to Auken,[1] is said to be "cicutoxin," a resinous substance.

Some specially noxious weeds, J. FLETCHER (*Canada Exptl. Farms Rpt. 1894, pp. 223–226, figs. 2*).—Brief descriptions are given of the Russian thistle, tumble mustard (*Sisymbrium sinapistrum*), *Erysimum orientale*, and the sow thistle (*Sonchus arvensis*). The attention of farmers and others is especially called to these weeds, that their spread may be prevented. The same warning is given regarding *Neslia paniculata* and false flax, which are every year becoming more troublesome.

Two noxious weeds, L. H. PAMMEL (*Iowa Sta. Bul. 28, pp. 199–211, pl. 2, figs. 6*).—The author gives illustrated descriptions and notes on the prickly lettuce (*Lactuca scariola*) and on the buffalo bur (*Solanum rostratum*). During the past season these two weeds were received for identification at the station more frequently than any others. The information relative to the prickly lettuce is largely compiled from Indiana Station Bulletin 52 (E. S. R., 6, p. 640). The article on the buffalo bur contains compiled and original observations on this rapidly spreading weed.

Growing of unripe seeds, T. CHRISTY (*Gard. Chron., ser. 3, 19 (1896), No. 475, p. 145*).—The author states that seed produced by young trees will, when grown, give trees of indifferent character, and cites the coffee tree as an example.

A new germination apparatus, C. ASCHMAN (*Chem. Ztg., 20 (1896), No. 7, p. 54, fig. 1*).

Distribution of prickly lettuce in the United States, L. H. DEWEY (*Bot. Gaz., 21 (1896), No. 1, pp. 34, 35, map 1*).—Notes are given upon the distribution of this

[1] Jour. prak. Chem., 1868, p. 105.

troublesome weed. It is reported from 27 States and Territories, being reported most abundant in the States of New York, Michigan, Ohio, Indiana, Illinois, Wisconsin, Iowa, and Kansas.

Is the cultivated parsnip run wild poisonous? L. H. PAMMEL (*Iowa Sta. Bul. 28, pp. 226-228*).—The substance of this paper has already appeared elsewhere (E. S. R., 7, p. 131).

Kansas weeds, A. S. HITCHCOCK and J. B. S. NORTON (*Kansas Sta Bul. 52, pp. 87-101*).—This bulletin is intended as preliminary to a study of weed distribution throughout the State. The distribution of 119 species, as represented by specimens in the herbarium, is given. A circular request for information accompanies the bulletin, in which is sought information as to common names, soil frequented, and abundance of the worst weeds of the State.

DISEASES OF PLANTS.

Report of work in vegetable pathology, E. S. GOFF (*Wisconsin Sta. Rpt. 1893, pp. 228-252, figs. 13*).—The author gives a report on the apple scab and its prevention, potato scab and the means for its repression, the use of Bordeaux mixture for potato blight, corn smut, onion mold, spot disease of strawberry leaves, and the hot-water treatment for the prevention of the smut of wheat and oats.

The experiments on the apple scab were in continuation of those previously reported.[1] Of the fungicides tested, Bordeaux mixture gave decidedly the best results. For the prevention of the scab of potatoes the corrosive sublimate treatment of the tubers is recommended. The use of Bordeaux mixture for the prevention of potato blight is strongly urged. Negative results are given of attempts to prevent corn smut, onion mold, and spot disease of strawberry leaves. For the prevention of the smut of wheat and oats the hot-water treatment is described and recommended.

Spraying experiments, J. CRAIG (*Canada Central Exptl. Farms Rpt. 1894, pp. 108-121*).—The author reports upon coöperative spraying experiments conducted during the season of 1894 by members of the Fruit Growers' Association of Ontario. The weather was very unfavorable for the proper conducting of the experiments, an excessive amount of rain having fallen during the earlier part of the season. Experiments were conducted for preventing the diseases of peaches, plums, cherries, pears, and apples. Bordeaux mixture of various strengths was used. A spraying calendar is given for various plants.

The experiments on peaches were not attended by marked results, owing largely to the absence of fungus diseases, but it was noticed that with some varieties the spot fungus was considerably worse upon the unsprayed trees.

Experiments conducted with plums showed that the foliage of the sprayed trees was vastly superior to the unsprayed. Two trees were

[1] U. S. Dept. Agr., Div. Veg. Path. Bul. 3 (E. S. R., 4, p. 500), and Wis. Sta. Rpt. for 1892, p. 264 (E. S. R., 5, p. 498).

selected, one sprayed and the other unsprayed. The fruit of each was gathered and weighed. The sprayed tree yielded 14½ lbs. of sound plums, the unsprayed 12. There was a most noticeable difference in the size and quality of the fruit from the sprayed tree. One hundred plums from this tree weighed 3 lbs. 9 oz., while 100 from the unsprayed tree weighed but 2 lbs. 1 oz.

Experiments were conducted on cherries by different individuals, the results of which show the efficiency of fungicides. One experimenter secured 130 lbs. of cherries from the sprayed tree, while from the unsprayed tree but 18 lbs. were gathered. The cherries were marketed, and netted for the sprayed tree $9.25, as compared with $1.20 for the unsprayed tree.

Experiments on pears showed that cracking and spotting may be prevented, with great benefit to the tree and fruit, by the timely application of Bordeaux mixture.

Experiments were conducted on quite a range of varieties of apples at different places, and the returns show that sprayed trees yielded 45.42 per cent first grade apples, 35.94 per cent seconds, and 18.63 per cent thirds; while the unsprayed trees averaged 21.42, 42.38, and 36.42 per cent, respectively.

An experiment was conducted with crab apples to prove the efficacy of Paris green when applied with Bordeaux mixture. The percentage of wormy fruit was as follows: Average of all trees treated with Paris green 13.80 per cent, treated with Bordeaux mixture and Paris green 11.32, showing that the trees treated with a combined insecticide and fungicide had 2.48 per cent less wormy fruit than those treated with Paris green alone.

Sixth annual report of the Halle Station for experiments in the repression of nematodes and for plant protection, 1894, M. HOLLRUNG (*pp. 19, pl. 1*).—During the year 609 experiments of all kinds were carried on at the station, an increase of about 50 per cent over the total for the previous year. The scientific work was in the main conducted along the following lines: (1) Fertilizer experiments with potash salts on beet-sick (nematode-infested) soils; (2) investigations on the influence of continued application of barnyard manure upon beet sickness; (3) experiments with unslacked lime for the repression of nematodes, and (4) field experiments on treatment of seed grain.

Considerable space is devoted to a report upon the fungus and insect enemies to which the sugar beet and other field crops are liable.

A series of coöperative experiments with kainit, carnalit, potassium chlorid, and sodium chlorid as affecting beet production in nematode-infested soils is reported upon. The results obtained were very inconclusive, being different for the different soil conditions. On this account the author says that the series of experiments shows that potash salts, while having a palliative effect, must not be considered as specific for nematode repression. It is further stated that different

soils require different forms of potash, the kind necessary to be determined by individual experimentation.

A statistical report is given of the occurrence of fungus and insect pests in Saxony during the seasons 1889–'94.

The report concludes with an account of the successful use of solutions of copper sulphate for the prevention of the smut of grains. The report shows a decided increase in the yield and a similar reduction in the amount of smut of barley from treated as compared with untreated barley. The vitality of the seed was affected by the treatment, on which account the author recommends the use of one-tenth more seed grain when treated seed is sown than when untreated is used.

The spraying of plants, E. G. LODEMAN (*New York: Macmillan & Co., 1896, pp. XVII+399, figs. 92*).—This work well represents the rapid advance that has been made in dealing with insects and fungus pests by means of sprays. The first part of it is devoted to the history and principles of spraying, in which are given the early history of liquid applications; progress of spraying in foreign countries, especially in France, where the modern treatment of fungus diseases may be said to have originated; spraying in the United States and Canada, where insect ravages were the incentive to studies that led up to the discovery of rational means for the repression of many troublesome enemies; the materials and formulas used in spraying; spraying devices and machinery; the action of insecticides and fungicides upon (1) insects, (2) fungi, (3) the host plant, (4) the soil, and (5) the value of the crop.

In part 2 specific directions are given for spraying cultivated plants. Illustrated descriptions of the most important fungus diseases and insects are given, together with suggestions as to what are now considered the best means for their treatment. An appendix is added, in which are given the laws of California, Canada, Massachusetts, Michigan, and Utah relative to the spraying of plants for the prevention of fungus and insect attacks. As many of the formulas are given in which the quantities used are expressed in metric measurements, a table is given of the metric system of weights and measures, together with their equivalents. The author has drawn extensively upon foreign literature, as well as the publications of this Department and the American experiment stations, and his work will no doubt be of value on account of the clear and concise statement of our present information relating to the subjects considered.

A bacterial disease of beets, F. GLAZER (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 25, pp. 879, 880*).—A disease due to *Bacterium gelatinosum betæ* is described.

On a parasite of the sugar beet, L. TRABUT (*Rev. Mycol., 18 (1896), No. 69, pp. 10, 11, fig. 1*).—The disease originally described as due to *Entyloma lephroideum* is here described as due to *Œdomyces lephroides*. See also E. S. R., 6, p. 646.

Concerning the root disease of peas due to Ascochyta pisi, L. HILTNER (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 25, pp. 881–886*).

A new potato disease (*Rev. Sci., ser. 4, 5 (1896), No. 6, p. 185*).—A brief account is given of the appearance of a new potato disease in Switzerland. The fungus, which is a species of Rhizoctonia, attacks the tubers. A similar species is known to infest the alfalfa roots, and it is thought the infection may be carried in this way from one crop to the other.

Diseases of Ficus spp., R. E. SMITH (*Bot. Gaz., 21 (1896), No. 1, pp. 35, 36*).—The author reports in the Massachusetts Agricultural College greenhouses a disease of *Ficus elastica* due to *Leptostromella elastica*. *F. religiosa* was attacked in what seemed to be the same way, but examinations proved the fungus to be a Macrosporium and the spots were thought to be due to a burn, the fungus living saprophytically upon it, producing a remarkably exact imitation of the other disease.

Lily blight, F. H. HORSFORD (*Garden and Forest, 9 (1896), No. 414, pp. 44, 45*).

On combating black rot, A. CARRÉ (*Prog. Agr. et Vit., 25 (1896), No. 2, pp. 35–39*).

Observations on the treatment of black rot, Z. ST. PÉ (*Prog. Agr. et Vit., 25 (1896), No. 3, pp. 74–77*).—The author's opinion is adverse to the efficacy of copper sulphate as a preventive of this disease.

On the expense of treatments for the prevention of black rot and mildew, P. COSTE-FLORET (*Prog. Agr. et Vit., 25 (1896), No. 2, pp. 46–51*).

Diseases of economic plants and methods for their prevention, A. VON REUSSE and L. KARM (*Fühling's landw. Ztg., 45 (1896), No. 1, pp. 21–24*).

Contributions on the plant diseases and injuries in the Netherlands during 1894, J. RITZEMA-BOS (*Ztschr. Pflanzenkrank., 5 (1895), No. 6, pp. 342–349*).

Mycological notes from Denmark, H. KLEBAHN (*Ztschr. Pflanzenkrank., 5 (1895), No. 6, pp. 335, 336*).—Notes are given of the occurrence of various fungi, among them *Tilœa maxilliformis*, n. sp., upon the roots of *Trifolium pratense*.

A new method for the application of copper sulphate, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 2, pp. 32, 33*).—A mixture of copper sulphate and calcium sulphate is described. The name polysulphatite is given it, and it is claimed to be always ready for application when diluted with water.

Chemistry of the copper salt fungicides, F. T. SHUTT (*Canada Exptl. Farms Rpt. 1894, pp. 171–175*).—The chemical reactions which are involved in the preparations of Bordeaux mixture, copper carbonate, ammoniacal copper carbonate, and eau celeste, as well as those which occur when Paris green is combined with Bordeaux mixture and ammoniacal copper carbonate, are discussed.

ENTOMOLOGY.

Work in economic entomology, E. S. GOFF (*Wisconsin Sta. Rpt. 1893, pp. 253–261, figs. 6*).—This contains brief notes on some investigations in regard to the treatment of injurious insects. A kerosene spraying apparatus that can be attached to force pumps and the kerosene mingled with the water at the moment of spraying is described and illustrated. It is described as being an easier and simpler method than the use of kerosene emulsion, while it is believed to be equally efficacious in destroying insects and equally harmless to plants.

Some experiments were carried on with this mixture of kerosene and water and with kerosene emulsion against the oyster-shell bark louse, (*Mytilaspis pomorum*), unhatched eggs of the pest on *Spiræa alba* being thoroughly wet with the application in June. Scales and eggs thus treated were completely destroyed, not a single insect remaining alive or a single egg hatching. On other twigs that had been sprayed with Bordeaux mixture and with a solution of caustic potash the pests were but little affected.

Pyrethrum is recommended as a remedy against house flies, cabbage worms, and lice on stock, the powder being applied by means of small bellows.

Efforts were made to poison cutworms by distributing clover, grass, etc., that had been treated with Paris green, where they congregated, with but small success. Trapping the larvæ by spreading piles of clover under which they assembled during the night, to be destroyed in the morning, was more efficacious.

An illustrated description is given of a tool for cutting hexagonal cards of tarred paper for placing about cabbage plants when transplanted, to prevent cabbage maggots from gaining access to the roots. Directions are given for cutting and applying the cards.

Injurious insects, J. FLETCHER (*Canada Exptl. Farms Rpt. 1894, pp. 186–218, figs. 18*).—Illustrated descriptive notes on the life history, habits, and treatment of some of the insects most injurious during the season, the pea moth (*Semasia* sp.), army worm (*Leucania unipuncta*), codling moth (*Carpocapsa pomonella*), plum curculio (*Conotrachelus nenuphar*), cigar-case bearer (*Coleophora fletcherella*), San José scale (*Aspidiotus perniciosus*), pear tree psylla (*Psylla pyricola*), peach bark borer (*Phlœotribus liminaris*), and spotted paria (*Paria sex-notata*) being treated at greatest length. The pea moth was quite abundant in some portions of the province, and early planting, rotation of crops, deep plowing, and the application of carbolized plaster to the growing crop are recommended as preventives and remedies.

The apiary (*Canada Exptl. Farms Rpt. 1894, pp. 219–223*).—Notes on the condition of the apiary and progress of the work. Several brands of "foundation" wax have been experimented with to test their comparative value, the result being that a foundation light in color and weight is to be preferred, although the investigations are not as yet completed.

The tea insects of India, E. C. COTES (*Indian Museum Notes, vol. 3, No. 4, pp. 74, II, figs. 37*).—This paper consists of illustrated descriptive, life history, and remedial notes on the various insects that have been observed attacking tea plants, with recommendations for apparatus and insecticides for combating them. The more important pests appear to be the white grub (*Lachnosterna impressa*), red or white borer (*Zeuzera coffeæ*), mosquito blight (*Helopeltis theivora*), green fly blight (*Chlorita flavescens*), *Phromnia marginella*, tea bark louse (*Chionaspis theæ*), cricket (*Brachytrypes achatinus*), white ants, and red spider (*Tetranychus bioculatus*). Of these mosquito blight, green fly blight, and red spider are treated at greatest length. Against the mosquito blight is recommended plucking infested branches and spraying with kerosene emulsion, against the green fly blight careful spraying with London purple, and against the red spider dusting flour of sulphur over the infested bushes. Detailed directions are given for the preparation and application of kerosene emulsion, pyrethrum, arsenical washes, and hydrocyanic-acid gas, and the use of hopperdozers for the destruction of grasshoppers and locusts.

Entomological observations in India (*Indian Museum Notes, vol. 3, No. 5, pp. 84, pls. 3, figs. 19*).—This consists of the following papers:

A decade of entomology in the Indian Museum, by E. C. Cotes, gives a summary of what has been accomplished during the past 10 years in the entomological section of the Indian Museum, briefly mentioning the collections made and received, and the original work undertaken, such

as a catalogue of the moths of India, investigations of the various insects that attack tea, cereals, and other crops in India, and study of the different silk insects of the country.

Parasitic Muscidæ from British India, by F. M. Van der Wulp, consists of technical descriptions of 9 species of flies bred chiefly from Lepidoptera, 7 of the species being described as new.

Notes on a new psyllid, by G. B. Buckton, describes as new the species *Phacopteron lentiginosum*, taken from galls on *Garuga pinnata*.

The banded mosquito of Bengal, by F. A. A. Skuse, gives a scientific description and brief note on *Culex albopictus*, a new species of mosquito which is stated to be a great nuisance at Calcutta.

Scale insects in Madras, by R. Newstead, contains notes on 6 species, 4 of them being considered new. *Dactylopius ceriferus*, infesting croton, and *Icerya ægyptiacum*, infesting various plants, are considered of economic importance, the latter in particular. The Icerya was found on a species of weed, and complete destruction of infested plants by burning is advised.

Notes on the oviposition of *Helopeltis theivora*, by G. C. Dudgeon, consists of a minute account of the process of egg laying by the mosquito blight, the eggs, each with two slender hairs at one end, being thrust in pairs into the green stem of a tea plant. It is believed that the hairs which project from the surface prevent the bark from healing and so facilitate the issuance of the young insects.

Miscellaneous notes from the entomological section, by E. C. Cotes, consists of brief observations on various insects that have been more or less injurious to crops and plants in India.

Exomalopsis, a neotropical genus of bees in the United States, T. D. A. COCKERELL (*Canadian Ent., 18 (1896), No. 1, pp. 25, 26*).—A technical description of *E. solani*, a new species of this South and Central American genus, found on *Solanum elaagnifolium* in New Mexico.

Beekeeping for the farmer and fruit grower, E. T. EMERSON (*Amer. Hort., 6 (1896), No. 1, pp. 1-3*).—A paper read before the Kansas State Board of Agriculture, in a general way giving information on beekeeping, and urging the extension of the industry.

Alsike clover for honey and forage, F. COVERDALE (*Amer. Bee Jour., 36 (1896), No. 5, pp. 65, 66, figs. 2*).—Urges the growing of this forage plant for bees and hay.

Beekeeping in Cyprus, O. K. BOVILL (*Gov't Printing Off. Nicosia, Cyprus, 1896, pp. 8*).—Notes are given in English, Modern Greek, and Arabic on the advantages of this island for bee raising.

A new genus and species of Sarcoptid inhabiting hair, TROUESSART (*Bul. Soc. Ent. France, 1896, Jan. 22, pp. 27-29*).—Description and notes on *Schizocarpus mingandi*, found on beavers in Europe and North America.

On the biology of the species of Chermes infesting larches, N. CHOLODKOVSKY (*Zool. Anz., 19 (1896), No. 494, pp. 37-40*).

Epitrix parvula beneficial rather than injurious to tobacco, S. H. SCUDDER (*Psyche, 7 (1896), No. 238, p. 347*).—Brief note.

Atta (Œcodoma) cephalotes, J. H. HART (*Ann. and Mag. Nat. Hist., ser. 6, 17 (1896), No. 98, pp. 160-162*).—Notes on the various forms of a colony of the parasol ant, the habits of the "soldier" being especially treated.

Mexican Formicidæ, T. PERGANDE (*Proc. Cal. Acad. Sci., ser. 2, 5 (1895), pp. 858–896*).

The North American species of Gnathodus, C. F. BAKER (*Canadian Ent., 28 (1896), No. 2, pp. 35–42*).

Some remarks on the insects belonging to the genus Palorus, G. C. CHAMPION (*Ent. Monthly Mag., ser. 2, 7 (1896), No. 74, pp. 26–30*).—A technical paper, a new species being described.

The Mediterranean flour moth, Ephestia kuehniella, still in Canada, W. G. JOHNSON (*Canadian Ent., 28 (1896), No. 1, p. 13*).—Brief note.

Italian scale insects infesting citrus fruits, A. BERLESE (*Riv. pat. Veg., 4 (1895), No. 1–6, pp. 74–179, figs. 106*).

Exotic Coccidæ in England, E. E. GREEN (*Ent. Monthly Mag., ser. 2, 7 (1896), No. 71, p. 11*).—Notes on *Parlatoria pergandei* found on an orange rind, and *Astrolecanium bambusa* on the stems of bamboo.

The red bug, J. HAMILTON (*Ent. News, 7 (1896), No. 1, pp. 2, 3*).—A popular account of the mode of attack.

Habits and parasites of a new California wasp, A. DAVIDSON (*Psyche, 7 (1896), No. 228, pp. 335, 336*).—Notes on *Odynerus rufobasilaris*.

An unknown Rhynchote upon Sinapis alba, VON DOBENECK (*Ztschr. Pflanzenkrank., 5 (1895), No. 6, pp. 324–327*).—Notes on the habits of an unidentified species, probably new.

Scolytus 4-spinosus, J. B. SMITH (*Ent. News, 6 (1895), No. 9, pp. 294–296*).—Various notes on the distribution and life history.

The development and life history of the gallfly Cynips calicis, H. F. KESSLER (*Abhandl. Bot. Ver. Naturk. Kassel, 40 (1894–'95), pp. 17–40*).—Notes on the habits and embryology of this species, and on the galls formed by it on the pistillate flowers of *Quercus pedunculata*. The galls are called "knoppern."

New gall mites, A. NALEPA (*Oesterr. bot. Ztschr., 46 (1896), No. 1, pp. 34, 35*).—The author describes *Phytoptus macrotuberculatus*, *P. rubsaameni*, *Phyllocoptes thomasi*, and *Trimerus gemicola*.

The elm leaf beetle, J. B. SMITH (*Ent. News, 6 (1895), No. 9, pp. 292, 293*).—Brief notes on the successful protection of trees at West Point, New York, by spraying with arsenate of soda and acetate of lead.

Winter work among insects injurious to fruits, M. V. SLINGERLAND (*Garden and Forest, 9 (1896), No. 413, p. 36. From Amer. Agr.*)—Some brief remarks on the subject, naming different methods of treatment, that can be carried on during the winter, as the burning of leaves, prunings, and rubbish; spraying with whale-oil soap solution and kerosene emulsion; and the hand gathering of large egg masses, cocoons, etc.

A new way to use kerosene, J. B. SMITH (*Ent. News, 7 (1896), No. 1, pp. 10, 11*).—Spraying tree trunks with kerosene during winter, and then setting fire to them to destroy any insects harbored by the crevices of the bark.

Preventive management of soils infested with phylloxera for the replacement of vineyards and the analogy between the theoretical process of A. Casali and the practical process of C. Oberlin (*Rpt. Agr. Chem. Lab. Bologna, 23 (1895), pp. 26–31*).

Concerning insect attacks in Hungary during the past year, K. SOJO (*Ztschr. Pflanzenkrank., 5 (1895), No. 6, pp. 359–364*).—The present paper gives accounts of attacks of Hemiptera and Orthoptera.

The Australian ladybirds receive kind notice, W. G. WAIT (*Hawaiian Planters' Monthly, 14 (1895), No. 8, pp. 349, 350*).—The work of the ladybird *Cryptolæmus montrouzieri* against *Pulvinaria psidii* is accounted just as marvelous as that of *Vedalia cardinalis*.

A new parasite of the Mediterranean flour moth (Ephestia kuehniella), W. G. JOHNSON (*Ent. News, 6 (1895), No. 10, pp. 324, 325*).—Notes on *Habrobracon hebetor*, and possibly another species, preying on this pest.

Capsus laniarius feeding on Aphids in England, J. W. DOUGLAS (*Ent. Monthly Mag., ser. 2, 6 (1895), No. 70, pp. 238, 239*).

Observations on the flight of dragon flies, C. BARROIS (*Bul. Soc. Ent. France, 1896, Jan. 22, pp. 25, 26*).—Thousands of Libellulidæ perched themselves on a telegraph wire in remarkably uniform positions.

A note on white insect wax, E. STIBBING (*Indian Agr., 20 (1895), No. 12, pp. 374, 375*).

Wax secreted by Lepidoptera, H. G. KNAGGS (*Ent. Monthly Mag., ser. 2, 6 (1895), No. 71, pp. 251, 252*).—Certain larvæ that are internal feeders, and many which make subterranean galleries, secrete wax for the purpose of waterproofing their tunnels.

The speculative method in entomology, R. MELDOLA (*Nature, 53 (1896), No. 1372, pp. 352–356*).—An address before the Entomological Society of London.

The entomology of the Illinois River and adjacent waters, C. A. HART (*Bul. Illinois State Lab. Nat. Hist., IV, 1895*).—The aquatic dipterous larvæ of this region.

Catalogue of the Coleoptera of southwestern Pennsylvania, with notes and descriptions, J. HAMILTON (*Trans. Amer. Ent. Soc., 22 (1895), pp. 317–380*).

FOODS—ANIMAL PRODUCTION.

Standards for rations and dietaries, W. O. ATWATER (*Connecticut Storrs Sta. Rpt. 1894, pp. 205–221*).—The author protests against the inconsiderate use of feeding standards on the grounds that they are only rough approximations, that feeding stuffs vary widely in composition, that we do not know exactly how the nutrients are used in the body, that it is impossible to lay down an accurate physiological standard for animals of any given kind, and that the question of cost of feeding stuffs and value of products are points involving consideration. He appears to favor what he calls "formulas for profitable feeding," to be found by "accurate observations of the actual practice of feeders and comparison of their methods of feeding with the product," and "coöperative experiments of a more thorough sort, such as the stations can best carry out with their own herds and near their own laboratories." But he calls attention to the fact that a profitable formula for one place or time may be very unprofitable for another. He stated that "an accurate physiological standard is out of the question," and that "a fixed formula for profit is utterly irrational." From statements elsewhere in the article it appears that what the author favors is less rigid adherence to fixed formulas for feeding, and consideration of the cost of different kinds of feeding stuffs—points which will very naturally suggest themselves as indispensable in the practical application of the principles of feeding.

Studies of dietaries, W. O. ATWATER and C. D. WOODS (*Connecticut Storrs Sta. Rpt. 1894, pp. 174–201*).—The work reported here is a continuation of that given in the Annual Reports of the station for

1892 and 1893 (E. S. R., 5, p. 594; 6, p. 443). The results of 8 dietary studies are reported in full. A summary follows:

Results of dietary studies—Food eaten per man daily.

	Protein.	Fat.	Carbo hydrates.	Fuel value.
	Grams.	*Grams.*	*Grams.*	*Calories.*
Widow's family	116	111	500	3,545
Swedish family	113	112	466	3,530
Do	133	123	636	4,300
College club	104	136	326	3,170
Divinity school club	122	138	317	3,085
Students' club (women)	105	160	330	3,270
Three chemists	116	170	467	3,980
Carpenter's family	115	126	537	3,850

Digestion experiments with sheep, C. S. PHELPS and C. D. WOODS (*Connecticut Storrs Sta. Rpt. 1894, pp. 107–122*).—Ten experiments on the digestibility of various food stuffs were made with Shropshire sheep about 1 year old. Experiments 1 to 4 were made with 2 animals, and experiments 5 to 10 with 3 animals. Each experiment lasted 12 days. During the last 8 days the feces were collected. Experiments 1 to 4 were made in connection with the feeding experiments with sheep reported on page 605. In the other experiments the food consisted of crimson clover, barley fodder fed green, barley and pea fodder, rowen hay (mostly Kentucky blue grass), and rowen hay (mostly timothy). The results are briefly given in the following table:

Average percentages of total nutrients of food actually digested.

Kind of food.	Number of tests.	Protein.	Fat.	Nitrogen free extract.	Fiber.	Ash.	Organic matter.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Wheat bran 4 oz., corn meal 12 oz. and hay 1 lb (wide ration)	4	55.0	68.5	76.4	55.3	23.0	69.0
Wheat bran 4 oz., corn meal 1 oz., linseed meal 3 oz., oat and pea meal 8 oz., and hay 1 lb (narrow ration)	4	73.4	70.5	74.8	62.7	29.2	71.6
Scarlet clover fodder, fed green	3	77.1	66.5	71.5	56.1	56.1	69.1
Scarlet clover hay	4	65.4	43.6	55.2	36.9	40.5	49.3
Barley fodder, fed green	2	70.4	62.2	72.8	56.3	55.9	56.5
Barley and pea fodder	2	77.2	59.7	61.4	43.5	46.2	60.2
Rowen hay and mixed grasses, chiefly Kentucky blue grass	4	69.1	46.2	65.1	66.5	53.0	65.2
Rowen hay, mostly timothy	4	68.0	49.5	63.4	66.5	56.4	64.4

Fuel value of digested nutrients in experiments with sheep, W. O. ATWATER and C. D. WOODS (*Connecticut Storrs Sta. Rpt. 1894, pp. 123–134*).—The object of these experiments was to determine the available fuel value of the rations in the feeding and digestion experiments reported above and on page 605. The available fuel value of a ration is equal to the total fuel value of the food consumed minus the fuel value of the excreta, the feces representing the undigested residue and the urea of the urine an intermediate combustion product of the digested protein. In these experiments the fuel value of the food and the feces was determined by burning samples in a bomb calorimeter.

Urea has been found to have a fuel value of 2.53 calories per gram. In these experiments the amount of urea furnished by the digested protein and its fuel value were determined by calculation as follows:

"Urea (CON_2H_4) contains 46.67 per cent of nitrogen. Hence nitrogen multiplied by the factor 2.143 equals urea. The protein as here estimated is the nitrogen multiplied by 6.25. Hence dividing the protein by 6.25 and multiplying the quotient by 2.143 gives the equivalent urea. Assuming that all of the digested protein is excreted as urea the number of grams of urea multiplied by 2.53, the fuel value of 1 gm. of urea, gives the total fuel value of the urea equivalent to the digested protein. But (protein divided by 6.25) $\times$ 2.143 $\times$ 2.53 = protein $\times$ 0.87. This last expression, protein $\times$ 0.87, therefore, represents the fuel value of the urea equivalent to the digestible protein."

In the table which follows the fuel value of the digested nutrients as determined by the method just described and as calculated by the ordinary method is given, also the per cent of protein digested and the available fuel value of the digested nutrients. This latter quantity is determined by dividing the fuel value of the digested nutrients by the fuel value of the food eaten.

Fuel value of digested nutrients.

Feeding stuffs.	Fuel value of digested nutrients. Calculated from analysis.	Fuel value of digested nutrients. Determined by bomb calorimeter.	Digested protein	Available fuel value.
	Calories	*Calories*	*Per cent.*	*Per cent*
Bran, corn meal, and hay	10,625	10,615	48.0	57.6
Do	12,050	12,230	62.1	66.4
Do	12,540	12,390	57.6	67.9
Do	12,045	11,805	52.2	65.2
Average			55.0	64.3
Wheat bran, linseed meal oat and pea meal, hay	11,785	11,920	73.5	63.6
	11,975	12,155	71.2	64.8
Wheat bran, corn meal, linseed meal, oat and pea meal, hay	12,585	13,120	77.1	70.3
	11,850	12,200	71.6	65.4
Average			73.4	66.0
Scarlet clover, fed green	9,730	10,110	76.7	63.7
Do	9,860	10,205	77.5	64.3
Do	7,860	8,160	77.2	64.3
Average			77.1	64.1
Barley fodder, fed green	7,415	7,935	69.3	57.8
Do	8,765	9,540	71.4	66.4
Average			70.4	62.1
Barley and pea fodder, fed green	7,025	7,460	81.1	60.2
Do	5,055	5,150	73.2	49.4
Average			77.2	54.8
Rowen hay, mixed grasses	9,280	9,905	69.1	60.9
Do	8,790	9,295	65.9	57.1
Do	9,865	10,500	66.9	58.1
Do	10,225	10,750	68.9	59.5
Average			67.7	58.9
Rowen hay, mostly timothy	9,470	10,180	66.1	59.3
Do	9,115	10,015	69.4	58.6
Do	9,445	10,005	68.2	58.3
Do	9,080	9,665	68.3	60.9
Average			68.0	59.3
Scarlet clover hay, field cured	4,740	4,825	63.9	42.4
Do	4,960	4,980	63.9	43.7
Do	4,940	5,070	65.1	44.5
Do	5,160	5,275	64.6	46.3
Average			64.4	44.2

These experiments are the first ones of this nature published, and no deductions are made.

A new form of bomb calorimeter, and determination of heats of combustion, W. O. ATWATER and C. D. WOODS (*Connecticut Storrs Sta. Rpt. 1894, pp. 135–157*).—A detailed description of the bomb calorimeter and the method of manipulation is given, as well as considerable historical matter relating to the general subject. This calorimeter was described at length in Bulletin 21 of the Office of Experiment Stations of this Department. The fuel value of a very large number of foods, feeding stuffs, and undigested residues was determined and the results, which include the calculated fuel value, were published in detail. The materials include different cuts of beef and other meats; dairy products; vegetable foods; milling products; hay, grain, and other fodders; and feces of man and sheep. In most cases the fuel value as determined was somewhat higher than the value obtained by calculation from the composition, using the ordinary coëfficients.

Examination of tea, coffee, and coffee substitutes (*Ztschr. Nahr. Untersuch. und Hyg., 9 (1895), No. 20, pp. 311–313*).—The methods of analysis of tea, coffee, and coffee substitutes, as adopted by the Association of Swiss Analytical Chemists at their convention in 1895, are given, and also definitions and standards for the components of these products.—F. W. WOLL.

Feeding experiments with Indian peas containing Lathyrus sativus, J. HUGHES (*Analyst, 20 (1895), No. 233, pp. 169–173, pl. 1*).—Indian peas containing about 20 per cent of *Lathryus sativus* (bitter vetch) were fed to a cow and a horse, in addition to other food. The object was to ascertain whether small quantities of the bitter vetch were poisonous, as has been claimed. Beginning with 1 lb. of peas per day, the amount was increased to 1½ lbs. after 2 weeks and continued for 2 weeks longer. At the end of that time the horse appeared "to have slight derangement of the digestive organs, the dung being loose and the animal's thirst increased, but there was neither illness nor sign of paralysis; its daily work was performed as usual, and the horse is still in excellent health."

The ration for the cow was increased to 2 lbs. of peas and continued for 2 weeks, "at this date there being no abnormal appearance in any respect nor sign of any paralysis, the cow having improved in general health and condition." The chemical and microscopic character of the Lathyrus are described and figured.

Angus and Shorthorn feeding experiments, J. WILSON and C. F. CURTISS (*Iowa Sta. Bul. 28, pp. 157–172*).

Synopsis.—In 2 trials 10 animals of each breed were fed the same rations. No marked differences in the gains made were observed. The animals were sold and slaughtered. Each breed gave equally good beef. A comparison of pasturage with and without grain was made with 2 lots composed of 5 animals of each breed. The addition of grain was not found profitable. Hogs following the cattle made profitable gains.

Three experiments were made with 10 two-year-old steers of each breed. The Shorthorns weighed 9,532 lbs. and cost 4 cts. per pound.

The Angus steers weighed 9,165 lbs. and cost 5 cts. per pound. In the first experiment, which lasted from April 1 to June 1, the 2 lots were fed practically the same ration, consisting of grain, hay, corn stover, and beets. Each lot was kept in a yard with a shed. The Angus steers made a daily average gain of 2.12 lbs. per head, the cost of 1 lb. of gain being 5.07 cts. The Shorthorns made an average daily gain of 2.66 lbs., the cost of 1 lb. of gain being 4.04 cts.

Fifteen days intervened between the first and second experiment. During this time the animals were prepared for pasture by feeding them grass and clover in increasing proportions. The Angus steers gained 151 lbs. and the Shorthorns 24.

The authors attribute the small gains to the laxative character of the green feed.

In the second experiment, which lasted from June 15 to July 16, there were 2 lots, of 5 Angus and 5 Shorthorns each. Lot 1 was fed on pasturage alone, and lot 2 was given daily 10 lbs. corn-and-cob meal per head in addition. One animal in lot 1 was sick and is not included in the calculation. Lot 1 made a daily average gain of 2.01 lbs., each pound of gain costing 1.65 cts. Lot 2 made a daily average gain of 2.13 lbs., each pound of gain costing 4.02 cts. The cost is based on pasturage at $1 per month per head and corn and cob meal at 50 cts. per 100 lbs. The gain was about the same in each case, and in the authors' opinion the experiment would not justify the addition of corn to pasturage.

In the third experiment, which lasted from August 1 to February 1, lot 1 was made up of the 10 Angus steers and lot 2 of the 10 Short horns. The animals remained on pasture until October, but were fed grain in addition. Later gluten meal and mangel-wurzels were also fed. The daily average gain of lot 1 was 1.86 lbs., the cost of 1 lb. of gain being 7.33 cts. The daily average gain of lot 2 was 1.86 lbs. per head, the cost of 1 lb. of gain being 7.47 cts. The average results agree very closely, but the detailed table shows "not only great monthly variations, but as marked variations within the breeds."

At the close of the experiment the animals were all sold and slaughtered. Each lot brought $5.65 per 100 lbs. The meat was cut up and priced by an expert, but no marked difference between the 2 breeds was observed.

The authors conclude that from the standpoint of feeding for beef the 2 breeds differ very little.

Hogs running with the cattle.—Twenty hogs ran with the steers from April 10 to August 18. They ate 7,938 lbs. of corn in addition, and gained 1,945 lbs. They were sold at a profit of $51.80. A second lot of 21 hogs ran with the cattle from October 6 to February 1. They were fed grain in addition. They were sold at a profit of $84.78.

Steer feeding experiment, IV, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 51, pp. 55–65, pls. 6*).

Synopsis.—A comparison was made of 6 Shorthorns and 6 scrub steers. The animals were yearlings when purchased and were pastured 2 summers on a hilly prairie pasture and wintered in open yards. The second fall they were taken up for fattening. In general, the Shorthorns were superior to the scrubs, giving the best returns for the food consumed. Hogs following the steers made profitable gains.

The object of these experiments was to compare improved and scrub stock, the latter term being used to indicate unimproved native stock. Shorthorns were selected as being the cheapest of improved stock which could be purchased in the locality. The lot consisted of 6 yearling steers, averaging 780 lbs. and costing $40 each. The scrubs were also yearlings, and cost $16 per head; the average weight was 415 lbs. All the animals were dehorned soon after they were purchased.

The 2 lots were pastured from May 25 to November 1. The Shorthorns were used to rich clover and grass pasture, and the change to hilly prairie pasture was greatly to their disadvantage. The scrubs made a better gain on this pasturage, as it was what they had been used to.

The 2 lots were wintered in yards with open sheds. They were fed on whole corn and cornstalks, with a little sorghum hay and similar coarse fodder, sufficient to keep them in good growing condition.

The second summer, from May 1 to November 1, was spent on pasture, and for the first few days the steers were fed a little corn to make the change from winter to summer feeding less abrupt. The average gains of each lot during these 3 periods are shown in the following table:

Weights, gains, and food eaten by Shorthorns and scrubs.

	Shorthorns				Scrubs			
	Food eaten daily per lot		Average daily gain	Total gain	Food eaten daily per lot.		Average daily gain.	Total gain
	Corn	Coarse fodder			Corn	Coarse fodder		
	Pounds	*Pounds*	*Pounds*	*Pounds.*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
First summer at pasture ..		.. ..	0 680	110	..	....	1 12	179
Winter feeding...	55 65	111 95	1 240	226	49 33	89 92	1.21	219
Second summer at pasture..........	146 00	345 00	0 410	76	140 00	345 00	1 03	190
Whole time, 525 days	.....	.. . .	0 784	412	......	.. ..	1.12	588

Under the conditions of the experiment the scrubs made a better showing than the Shorthorns. The author explains this by the fact that the scrubs were by ancestry and from birth accustomed to these conditions. The Shorthorns made a daily gain of 1.63 lbs. from birth until their arrival at the station. It is believed that if they had been kept under the same conditions as at first they would have made uniformly good gains. Each lot was in fair average condition.

The 2 lots of steers were fattened from November 1 to April 11,

under conditions similar to those prevailing on farms. They were put in adjoining yards and were fed twice a day. The feed consisted of ground wheat and cut cornstalks (inch pieces) for the first 2½ months, on which they made excellent gains at first. Later the gains were irregular, and corn meal was added in increasing proportion, and later a little cotton-seed meal. The last week of the fattening period corn meal and 2 lbs. of cotton-seed meal per head were substituted for the wheat. Each lot was given all the food it would eat up clean. The animals had access at all times to water and salt. At the last weighing the Shorthorns averaged 1,517 lbs. and the scrubs 1,272 lbs. In the following table the 2 lots are compared during the fattening period. The prices are based on ground wheat at 81¼ cts. per 100 lbs., corn meal at 85¼ cts., cotton-seed meal at 85 cts., and cut corn fodder at 28 cts.

Weights, gains, and food eaten by Shorthorns and scrubs during fattening period.

	Total grain eaten by lot	Total food eaten by lot	Total gain of lot	Average daily gain per head	Total food eaten per pound of gain	Average cost of food per pound of gain
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Cents*
Shorthorns	15,172	27,267	1,951	2.018	13.97	8.30
Scrubs ...	14,662	21,254	1,674	1.731	12.69	8.49

The animals were sold for slaughtering. The Shorthorns averaged 245 lbs. per head more than the scrubs, and owing to their better beef they made a decidedly better appearance. The buyers were at first inclined to put the same price on all, but finally decided to give $5.63 per 100 lbs. for the 3 heavier Shorthorns and $4.64 per 100 lbs. for the 3 remaining Shorthorns and all of the scrubs. The total cost of feeding the Shorthorns was $280.23, and they sold for $470.68. The total cost of feeding the scrubs was $248.71, and they sold for $358.51. Tables give the results of slaughtering and the block test, *i. e.*, valuing the meat after cut up. On slaughtering, the scrubs yielded a larger per cent of offal and a smaller per cent of beef than the Shorthorns.

By the block test the Shorthorns were valued, taking the average of all cuts, at from $7.94 to $8.49 per 100 lbs. and the scrubs at from $7.26 to $8.51, the valuation in general being a little lower for scrubs than for Shorthorns.

The conclusions drawn by the authors from these experiments are that the Shorthorns gave the best returns for the feed consumed, and that, too, under conditions unfavorable to them and to which they were previously unaccustomed as a breed. They showed themselves inferior grazers on prairie pasture. The scrubs did remarkably well considering the fact that they were not backed by improved ancestry. It is remarked that the Shorthorns did not do as well as might have been expected, and this is attributed to the fact that the conditions were better suited to scrubs than to the improved cattle. The experiments

emphasize the fact that improved breeds need improved conditions to obtain the best results.

At the conclusion of the description of the experiment photographic reproductions are given of all the steers.

Hogs running with the steers (pp. 78, 79).—In connection with the above experiment 4 grade Berkshire pigs were allowed to run with each lot of steers, the idea being to feed whatever extra food was required. In the 162 days of the experiment each lot consumed 2,876 lbs. of grain. At first wheat was fed, then wheat and corn meal, and later corn meal only. The 4 hogs running with the Shorthorns gained 724 lbs., each pound of gain costing 3.35 cts.; those running with the scrubs gained 674 lbs., each pound of gain costing 3.60 cts. All were in fine marketable condition and brought $4.85 per 100 lbs. The total expenditure for the pigs running with the Shorthorns was $27.08, and they sold for $51.41. The total expenditure for the pigs running with the scrubs was $27.08, and they sold for $48.98.

Experiments in feeding steers, A. MACKAY (*Canada Exptl. Farms Rpt. 1891, pp. 380, 381*).—Two sets of experiments in feeding steers were carried on. In the first experiment 6 two-year old steers were divided into 3 lots of 2 each. The experiment was continued for 4 months, 1 month being preparatory. Lot 1 received a ration of 35 lbs. of silage, 5 lbs. of meal (barley and oats ground), and oat straw. Lot 2 was fed 15 lbs. of cut dry fodder, 20 lbs. of turnips, and 5 lbs. of meal. Lot 3 was fed 18 lbs. of hay, 20 lbs. of turnips, and 5 lbs. of meal. Lot 1 made a gain of 497 lbs.; lot 2, 422 lbs.; and lot 3, 332 lbs. The 6 steers were bought for 2¾ cts. and sold for 3¼ cts. a pound.

In the second experiment 3 five-year-old steers were fed for 5 months as follows: Steer 1 was fed daily 50 lbs. of silage, 8 lbs. of meal, and straw; and gained 120 lbs. Steer 2 was fed daily 25 lbs. of cut fodder, 8 lbs. of meal, and 20 lbs. of turnips; and gained 255 lbs. Steer 3 was fed daily 25 lbs. of silage, 15 lbs. of cut feed, and 8 lbs. of meal; and gained 270 lbs. The animals cost 3 cts. per pound and were sold for 3¾ cts. per pound. In this experiment "silage, cut feed, and meal gave the most gain in weight and realized the greatest amount of money for feed consumed."

A study of rations fed to milch cows on six dairy farms in Connecticut, C. D. WOODS and C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1891, pp. 26–56*).

Synopsis.—A study was made of the rations fed to 6 herds on 6 farms in Connecticut. In 3 cases changes in the rations were suggested, making them narrower, and 4 weeks later a second test was made. The authors note that the change to narrower rations in the case of each herd served to keep up the yield of milk and butter in spite of advancing lactation and diminished the cost. In conclusion a feeding standard is tentatively suggested.

Six herds on private farms in the State were selected after personal inspection or after satisfactory correspondence. The number of cows

in the different herds ranged from 14 to 19, there being 95 cows in all. Two-thirds of this number were either grade or pure Jerseys and Guernseys. The tests of 4 herds lasted 12 days and of 2 herds 5 days. A station assistant was at each farm during the test, weighing the food eaten and the milk produced by each cow, taking samples of the feeding stuffs for analysis, testing the milk of each cow for every milking, and making a record of the breed, weight, and stage of the milking period. Any uneaten food was weighed back.

Analyses of the feeding stuffs were made at once and the weights of nutrients in the rations as fed were calculated. For 3 herds other rations were suggested by the authors, and the owners gradually changed the food to the rations proposed. In each case 4 weeks after the close of the first test another 12 day test was made for each of these 3 herds, and a comparison was made of the yields of milk and butter fat with the two different rations. The data are given in detail for each cow in each test, and from these summaries are made of the maximum, minimum, and average daily yields of milk and of fat, and of the total and digestible nutrients in the rations and the fuel value of the same. The summaries for the 6 herds on the rations as originally fed and for the 3 herds on the suggested rations, including the milk and butter produced and the cost of the latter, are given below:

Original and suggested rations fed to cows on six farms in Connecticut

Herd	Ration	Average daily ration per 1,000 lbs. live weight					Average daily yield of		Average cost of food		
		Digestible protein	Digestible fat	Digestible carbohydrates	Nutritive ratio	Fuel value	Milk	Butter[1]	Total per cow per day	Per 100 lbs. of milk	Per pound of butter[1]
		Pounds	*Pounds*	*Pounds*		*Calories*	*Pounds*	*Pounds*	*Cents*		*Cents.*
No. 18[2]	Original	2.60	1.00	16.45	1:7.3	39,700	18.1	1.07	26.6	$1.47	25
	Suggested	2.90	.99	14.03	1:5.7	35,600	18.9	1.09	21.7	1.15	19
No. 19	Original	2.70	.93	13.13	1:5.7	33,300					
No. 20[3]	do	1.97	.64	15.09	1:8.5	34,400	18.1	.87	18.6	1.00	21
	Suggested	2.68	.66	13.55	1:5.7	32,950	17.9	.89	18.3	1.03	20
No. 22[4]	Original	1.91	.56	12.51	1:7.3	29,200	13.7	.65	19.4	1.41	30
	Suggested	2.48	.71	12.54	1:5.8	30,900	13.6	.69	17.8	1.30	26
No. 24	Original	3.48	.82	14.82	1:4.8	37,500					
No. 26	do	2.52	1.05	10.47	1:5.2	28,600					

[1] Calculated on basis of 85 per cent of fat in butter.
[2] Nineteen cows in each test, but 4 were changed between the 2 tests.
[3] Sixteen cows in each test, but 1 changed between the 2 tests.
[4] Sixteen cows in first test and 12 of these in second test.

"[In the cases where the suggested narrower rations were tried] in general there was the largest yield of milk and the largest butter production with narrow rations rich in protein. Wide rations low in protein did not in these instances favor large milk or butter production.

In the 3 tests of 1893-'94, when it was possible to study the financial side of the feeding, narrow rations rich in protein were decidedly the more economical."

In addition to the above tests the results are cited of the previous test of 16 herds referred to above, and these and the present tests of 6 herds are summarized. In these 22 rations the digestible protein per

1,000 lbs. live weight ranged from 1.35 to 3.48 lbs.; the nutritive ratio from 1 : 4.5 to 1 : 11.3; and the fuel value from 28,600 to 42,600 calories. The average amounts of nutrients per 1,000 lbs. live weight in these rations were as follows:

Average of twenty-two rations fed to cows in Connecticut.

	Protein	Fat	Carbohydrates.	Nutritive ratio	Fuel value.
	Pounds	*Pound*	*Pounds*		*Calories.*
Concentrated food	1 59	0.56	4 72	1 : 3.1	14,050
Coarse food	.89	.35	9 23	1 : 11 3	20 200
Total food	2.48	.91	13.95	1 : 6 4	34,250

"It is probably true that the animals of most of the herds examined were, so far as breed, milk, and butter product are concerned, above the average of cows kept for dairy purposes in Connecticut. It is doubtless true that the feeding practiced by the owners of these herds is better than that which is generally practiced throughout the State. . . .

"Bearing in mind that there is no such thing as a 'best ration' and that all attempts to express in terms of protein and energy the needs of a dairy cow are only approximations, the following ration is tentatively suggested as a basis for feeding dairy cows: Organic matter, 25 lbs.; digestible protein, 2.5 lbs., and enough digestible fat and carbohydrates to bring the fuel value up to about 31,000 calories."

Variations of milk yield caused by variations in milking, F. E. EMERY (*North Carolina Sta. Bul. 116, pp. 191, 195*).—On 2 days, September 19 and 21, a rather vicious cow was milked normally and the teats in different order. The milk yield and the fat content given show considerable variation, which is attributed "mainly to interference with the regular order of milking and excitement of the nervous system of the cow." The first milk and strippings of the same cow showed characteristic differences in fat content. These results are believed to show "the extreme care and attention to details and quiet, orderly habits necessary to have animals thrive and give profitable returns."

A test showing that cows are affected by changes in stable routine, F. E. EMERY (*North Carolina Sta. Bul. 116, p. 196*).—The effect is noted on cows accustomed to being fed before milking of not feeding them at that time. One cow which commonly gave 7⅜ lbs. of milk per day only gave 1 lb. at a milking; the next milking was larger, but did not make up for the loss. Another cow whose milk tested from 3.6 to 4.4 per cent contained only 1.6 per cent when the grain was not given before milking. "This is a serious loss, and one which can be repeated with this cow at any time if she is not regularly fed. Lack of attention to these small things is costing many a man the better part of the profit of his dairy."

Feeding experiments with sheep, C. D. WOODS and C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1891, pp. 92–106*).—The object was to determine the effect of a wide and a narrow ration on the chemical com-

position of the flesh of sheep. The experiments are in continuation of work published in the Annual Report of the station for 1893 (E. S. R., 6, p. 463). They were made with grade Shropshire lambs, the average weight being 50.9 to 61.1 lbs. The animals were divided into 3 lots of 5 (A, B, and C) and 1 lot of 6 (D). Four similar animals were selected for digestion experiments, reported elsewhere (p. 597).

At the beginning of the experiment lot A, believed to represent the average of all, was slaughtered and the flesh analyzed. Lots B and C were placed in separate pens and fed individually. Lot D was fed collectively. From November 16 to March 29 lot B was fed a wide ration consisting of 12 oz. of corn meal, 40 oz. of wheat bran, 16 oz. of hay, and 4 oz. of turnips. Lot C was fed between the same dates a narrow ration consisting of 4 oz. of a mixture of 3 parts linseed meal and 1 part corn meal, 8 oz. of oats and pea meal, and 4 oz. of wheat bran, and lot D was fed this narrow ration from November 16 to April 13. One animal in lot B and 1 in lot C were not thrifty. They are not included in the average.

At the end of the experiment the sheep were all sheared and slaughtered, and the flesh was analyzed. The data for the experiment, including amount and composition of food eaten, weight of the animals at the beginning and end of the experiment, weight of carcasses and parts, and analyses of flesh, are tabulated. A summary of the food eaten and the gains made is given in the following table:

Digestible nutrients eaten by sheep on wide and narrow rations.

	Digestible nutrients in food.				Fuel value of food
	Total organic matter.	Protein	Fat	Carbohydrates.	
Nutrients in ration	*Pounds*	*Pounds*	*Pound*	*Pounds.*	*Calories*
Wide ration	1.17	0.13	0.06	0.98	2,320
Narrow ration	1.24	.26	.05	.93	2,425
Nutrients eaten per pound of gain in live weight					
Wide ration	7.31	.81	.38	6.13	14,500
Narrow ration	6.20	1.30	.25	4.65	12,100
Nutrients eaten per pound of gain in dressed weight					
Wide ration	14.62	1.62	.76	12.26	29,000
Narrow ration	12.40	2.60	.50	9.30	24,300

The average weights of the flesh and the nutrients in the flesh are summarized in the following table:

Average weights of flesh and nutrients in flesh of sheep.

	Live weight.	Dressed weight without kidneys and boots	Refuse (bone).	Edible portion (flesh).	In edible portion (flesh)			
					Water.	Protein.	Fat.	Ash.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Sheep at beginning of experiment	60.8	23.97	5.10	18.87	10.43	3.09	5.18	0.166
Sheep with wide ration	84.4	33.99	6.11	27.88	15.11	4.09	8.75	.245
Sheep with narrow ration	86.9	35.98	5.89	30.09	16.27	4.85	8.69	.272

Deducting from the edible portion of the average carcass at the beginning of the trial the edible portion of the average carcass at the end of the trial of the groups fed on wide and narrow rations, the edible flesh gained during the experiment and its constituents are as follows:

Differences in weights of nutrients with different rations.

	Edible portion (flesh)	In edible portion (flesh)			
		Water	Protein	Fat.	Ash
Increase since beginning of experiment:	*Pounds*	*Pounds*	*Pounds.*	*Pounds*	*Pound.*
Wide ration group	9 01	4 68	1.00	3.57	0 08
Narrow ration group	11 22	5 84	1 76	3 51	.10
Increase of narrow ration over wide ration group	2 21	1 16	76	– 06	02

The authors comment on the experiment as follows:

"The experiment has been continued through 2 years with no very decisive results. That food determines to a great extent the character and chemical composition of the flesh is made clear, but the animals made so little growth that it is unwise to draw definite conclusions of a practical nature from the results of the experiments."

Feeding cotton seed and other meals to hogs, C. F. CURTISS (*Iowa Sta. Bul. 28, pp. 173–179*).

Synopsis.—Cotton-seed meal and gluten meal as part of a ration were compared with corn and-cob meal. Cotton seed meal increased and cheapened the gains, but when fed in sufficient amount proved fatal.

Fifteen Poland China shoats weighing 1,480 lbs. were purchased and divided into 5 lots of 3 each. Each lot was kept in a pen in a feeding barn and had the run of a gravel lot in good weather. Salt and ashes were given to all. For 2 weeks before the experiment the lots were fed a uniform ration of corn-and-cob meal and buttermilk.

The experiment lasted from March 9 to May 31. During this time all the lots received corn and cob meal and buttermilk, but there was substituted for an equal amount of the corn and-cob meal ½ lb. of cotton-seed meal in case of lot 2, 1 lb. of cotton seed meal in case of lot 3, and 1½ lbs. of gluten meal in case of lot 4. Lot 5 was was fed ½ to 1 lb. of cut clover hay (soaked 12 hours) in addition to the corn-and-cob meal and buttermilk. All the grain was soaked 12 hours.

In addition to the above experiment one lot of 3 similar pigs ran with cattle which were fed 7 lbs. of cotton-seed meal daily.

The pigs all did well until toward the end of April, when 2 in lot 3 died. The cotton-seed meal was discontinued and the remaining pig in lot 3 recovered. One pig in lot 2 also died. Its symptoms were failing appetite and quickened breathing. The 2 remaining pigs in lot 2 showed these symptoms, but survived, giving very small gains during the last 31 days. An examination did not show any acute disorder to which the death of the pigs could be attributed.

The result, showing food consumed and gains made, are summarized in the following table:

Results of feeding pigs on different rations.

Lot.	Total food consumed. Corn-and-cob meal.	Butter-milk.	Cotton-seed meal.	Gluten meal.	Cut clover.	Daily gain per head.	Total gain per 100 lbs. dry matter in feed.	Nutritive ratio.
	Pounds.	*Pounds*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*1:*
1	1,304.00	984	....	....	....	1.13	23.7	10.2
2	857.00	696	82.25	....	....	1.26	26.4	9.4
3	*599.25	516	108.50	....	....	1.40	31.1	8.7
4	1,030.50	924	....	262.5	....	1.30	27.2	8.7
5	1,304.00	900	....	....	220.5	1.05	19.2	9.4
6 (following cattle)	190.00	960	44.50	....	....	.91	....	....

The following conclusions were reached:

"(1) Cotton-seed meal is fatal to hogs when fed in sufficient quantity; the total amount required to prove fatal being in this case from 27 to 33 lbs. per hog. . . .

"(2) Cotton-seed meal added to a corn-and-cob meal ration for hogs materially increased and cheapened the gains over corn-and-cob meal alone.

"(3) Cut clover hay added to a corn-and-cob meal ration and soaked 12 hours before feeding gave no advantage in gain over corn-and-cob meal alone."

No injury was sustained by the hogs running 17 weeks with cattle consuming 4 to 7 lbs. of cotton-seed meal daily.

Feeding of swine, J. W. ROBERTSON (*Canada Exptl. Farms Rpt. 1894, pp. 78–86*).—These experiments are a continuation of those made in previous years (E. S. R., 6, p. 465). Three series of experiments were made. In the first series 5 lots of pigs of mixed breeds and 2 lots of pure breed were fed 8 or 12 weeks a ration composed of equal parts by measure of ground barley, rye, frosted wheat, and wheat bran (soaked in cold water from 8 to 12 hours), and 3 lbs. of skim milk per head daily. On an average, 3 lbs. of the grain mixture and 2.32 lbs. of skim milk were consumed per pound of increase in live weight. The conclusions are reached that on the whole cross-bred swine and grades gave better results than pure-bred animals. However, "there was no constant or appreciable superiority in the breeds and breeding tested in respect to the quantity of feed consumed per pound of increase in live weight."

In the second series, which lasted from February 21 to March 18, 6 cross-bred pigs were divided into 3 even lots. They were fed a ration composed of equal parts by weight of peas, wheat, and rye, ground and soaked in cold water on an average 18 hours. Two of the lots were given skim milk in addition. Lot 1 was fed as much of the mixture as they would eat, consuming 3.43 lbs. per pound of increase in live weight. Lot 2 was fed three-quarters as much of the mixture as was consumed by lot 1 and as much skim milk as they would drink in addition. They consumed 2.17 lbs. of the meal and 11.1 lbs. of milk per pound of increase in live weight. Lot 3 was fed half as much of the mixture per day

and as much skim milk as they would drink. They consumed 1.44 lbs. of meal and 15.39 lbs. of milk per pound of increase.

From these experiments and from those made in past years the conclusion was reached that "when a small quantity (about 3 lbs. per day) of skim milk was fed a less quantity of it was equal to 1 lb. of the grain in the feed consumed per pound of increase in live weight than when a large quantity (about 15 lbs. per day) was fed." Further, the author concludes that skim milk may form a larger part of the feed of young and growing pigs with advantage and economy. He believes it economical to give not over 5 lbs. of skim milk per head daily to fattening swine weighing over 500 lbs. The animals which were fed skim milk as part of their ration had a more vigorous and healthy appearance than those fed grain.

The third series, which lasted from July 25 to October 10, was made with 14 pigs. They were divided into 2 lots of 5 each and 1 lot of 4. The object of these experiments was to discover the cause of "soft" hogs. It was thought that this "softness" was possibly due to feeding wheat or buckwheat. Lot 1 was fed a mixture of equal parts by measure of ground barley, rye, wheat, and wheat bran, which was soaked in cold water for about 30 hours. They consumed an average of 4.24 lbs. per pound of gain. Lot 2 was fed on ground wheat, which was soaked in cold water for about 30 hours, and consumed 4.1 lbs. per pound of gain. Lot 3 was fed on ground wheat, soaked in cold water for about 30 hours, and consumed 4.45 lbs. per pound of gain. The swine were all sold and slaughtered. The conclusion is reached that "the feeding of wheat alone and of buckwheat alone is not always a cause of 'soft' hogs and 'soft' sides, since some of the swine fed on wheat and buckwheat yielded sides classed as firm."

From the feeding experiments, which extended over 3 years, on the fattening of over 100 swine upon grain the following general conclusions are reached:

"(1) On the average 4.38 lbs. of grain (barley, rye, peas, wheat, frosted wheat, and wheat bran) was the quantity consumed per pound of increase in the live weight.

"(2) In the feeding of grain, considering quantity of feed consumed, and the general health of the animals, it is profitable to feed the grain ground and soaked in water for an average period of about 30 hours.

"(3) It is profitable to add about 3 or 5 lbs. of skim milk or buttermilk per head per day to the grain fed to fattening swine."

Experiments in feeding swine, A. MACKAY (*Canada Exptl. Farms Rpt. 1894, pp. 381, 382*).—Two sets of experiments were made. In the first experiment 1 lot of 4 pigs was fed from December 6 to April 6 on wheat soaked for 24 hours. They consumed 2,160 lbs. of wheat and made a gain of 467 lbs. A second lot of 6 pigs was fed on boiled wheat. They consumed 2,100 lbs. of wheat and made a gain of 351½ lbs. It took 4⅔ lbs. of soaked wheat or 6 lbs. of boiled wheat to make a pound of pork.

Wheat vs. barley and wheat.—In this experiment 10 Improved Large

Yorkshires, about 8 months old, were divided into 2 uniform lots of 5 pigs each. The experiment lasted from September 1 to November 1. Lot 1 was fed soaked wheat. They consumed 1,575 lbs. of wheat and made a gain of 202 lbs., or $8\frac{1}{2}$ lbs. of feed to 1 lb. of gain. Lot 2 was fed soaked wheat and barley mixed. They consumed 1,668 lbs. and made a gain of 275 lbs., or 6 lbs. of feed to 1 lb. of gain. The pigs were small for their age when the experiment began, and in the author's opinion this may account for the large quantity of grain consumed in comparison with the gains made.

Experiments with horses on the digestibility of various rations and the mechanical equivalent of food, E. WOLFF and C. KREUZHAGE (*Landw. Jahrb., 21 (1893), No. 1–2, pp. 125–271*).—These experiments are in continuation of work done between the years 1876 and 1887.[1] Seven series of experiments made between 1887 and 1894 are reported. The object was to determine the digestibility of various rations and the mechanical equivalent of the food consumed. The experiments were all made with the same horse, which in 1887 was about 5 years old. His weight, in good condition, was about 500 kg. The amount of each article of food consumed and the weight of the urine and feces were determined. The dry matter, protein, fat, crude fiber, nitrogen free extract, and ash in food and feces were determined and the nitrogen in the urine.

The amount of work done was measured by means of a specially constructed instrument, a "horse dynamometer," which is a circular horse-power machine, described in an earlier publication.[2] By means of weights the amount of work done could be regulated. The instrument was inclosed in a suitable building, and thus errors due to great variations in temperature could be avoided.

The ration in these experiments consisted of oats and meadow hay. In most cases either oat or spelt straw was consumed also. In several cases corn or beans were substituted for part of the oats. In some experiments definite quantities of salt were also given.

In all, 60 experiments are reported. For each very full tables are given, showing the amount and composition of the food consumed and digested, the nitrogen in the urine, the amount of nutrients digested (computed on the assumption that 1 gm. of protein=1 gm. of carbohydrates=2.4 gm. of fat), and the nutritive ratio.

In the authors' opinion the nutritive material in coarse fodder does not have the same nutritive value as that in concentrated food. This is true not only of the crude fiber but also of the other compounds which are nitrogen free or contain nitrogen. Many of the latter are amid compounds.

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[1] Landw. Vers. Stat., vols. 20, 21; Landw. Jahrb., vols. 8 to 13, 16, sup. III. Grundlagen für die rationelle Fütterung des Pferdes, Berlin, 1885; Neue Beitrage zu Grundlage, etc., 1887.

[2] Landw. Vers. Stat., vol. 21, pp. 21–29.

It requires a greater expenditure of energy to masticate and digest coarse fodder. The methan fermentation in the intestinal tract destroys crude fiber and other carbohydrates. The authors are therefore of the opinion that more trustworthy results are obtained if the crude fiber is left out of account in the calculations. It is certain that the results thus obtained are more harmonious.

The weight of the animal each day of the experiment was recorded, also the temperature of the air and the amount of water consumed. The amount of external work done was computed from the number of revolutions of the circular horsepower machine and other data which were recorded. In the authors' opinion the relation of food to work was shown in the following ways: (1) If the horse consumed a certain ration and performed a certain amount of work and at the same time his weight remained practically unchanged the ration was just suited to the work performed; and (2) the same fact was shown if the amount of nitrogen excreted in the urine was equal to the amount assimilated, *i. e.*, if the animal was in nitrogen equilibrium.

The authors conclude that 3,300 gm. of nutrients (without crude fiber) per day are sufficient to maintain a horse weighing 500 kg. and doing no work. If work is performed more food must be supplied. Thirty-four and three tenths per cent of the energy of the available food (without crude fiber) is transformed into external work. That is, a horse produces as external muscular work about 60,000 kilogram meters of the mechanical energy calculated from the fuel value of 100 gm. of nutrients. On the ground of theoretical consideration this should perhaps be 55,000 kilogrammeters. This is much lower than the value, 85,400 kilogrammeters, which was obtained in earlier experiments. This value varies somewhat in the different experiments, and is much lower than the value obtained before some improvements in method, which are described in detail, were adopted.

A ration which has a nutritive ratio of 1:6 to 7 when crude fiber is included, or 1:5.5 to 6.5 when it is not included, is considered to be the most advantageous for work horses for the production of external labor. This is in harmony with the ration of oats and hay or straw which is ordinarily fed. Oats, as is well known, are much relished by horses, and agree with them. That this is due to any peculiar constituents or properties could not be determined with certainty. These experiments, and those of Grandeau and Le Clerc,[1] in the authors' opinion, show that for the production of energy oats can be replaced by any other easily digestible concentrated food, though it would seem best on account of palatability not to omit them altogether. A suitable ration of this sort for a horse of 500 kg. weight would consist of 3 kg. of meadow hay, 2.5 kg. chopped straw (in this case from winter spelt, a variety of wheat), 1 kg. oats, 1.5 kg. field beans, 4 kg. corn, and 20 gm. salt. The nutritive ratio, including crude fiber, is 1:6.4; without

[1] Etudes expérimentales sur l'Alimentation du Cheval de Trait, 1883, 1887, 1889.

crude fiber, 1:5.8. A more concentrated ration is desirable if the horse has not been used to a voluminous ration, or if more work must be performed, for instance, drawing a wagon at a rapid rate.

Some of the conclusions reached regarding the digestibility of the fodder are the following:

(1) The consumption of a suitable quantity of straw often favorably influences the digestibility of the food, particularly when the horse is used to a relatively voluminous ration.

(2) Changes in the amount of work performed each day did not exert a definite influence on the digestibility of the food, provided the horse walked at a uniformly slow rate.

(3) Increasing the ration of oats, or in general the amount of concentrated food, often diminishes the digestibility of the crude fiber in the hay or in the whole ration.

(4) Feeding salt (20 and 40 gm. per day) has no influence upon the digestibility of food.

(5) Including crude fiber, 2½ kg. of meadow hay contains practically the same amount of nutrients as 1½ kg. of oats. Not including crude fiber, the relation is about 2:1.

(6) The fat and the crude protein in oats are more easily and apparently better digested than in corn.

(7) The total organic substance of corn is better digested than the organic substance of field beans, but the protein of beans is relatively and absolutely better digested.

(8) In the amount of nutrients which they contain and in the amount of labor which can be produced, 4 kg. of oats have about the same value as 3½ kg. of field beans. Further, 4 kg. of beans are about equal to 3½ kg. of corn; that is, oats, beans, and corn are in nutritive value in about the proportion of 5:4.5:4.

Among the conclusions reached concerning the amount of water consumed and excreted are the following:

(1) The amount of water consumed is increased by the weight, but more especially by the volume of the ration, and also by the amount of crude fiber consumed. Further, beans increased the water consumption more than corn. The consumption of salt also increased the water consumed.

(2) Variations in the amount of work performed exercised a marked influence on the consumption of water.

(3) Increasing the amount of coarse fodder increased the water content of the feces and increasing the concentrated food diminished it.

(4) In these experiments the dry matter in the feces varied from 17 to 27 per cent.

(5) With concentrated food the amount of water excreted in the urine is increased, and especially so with food rich in nitrogen, such as field beans.

(6) Salt increases the excretion of water in the urine, but has little effect on the excretion of water in the feces.

(7) That increasing the amount of work must increase the water excreted in the form of perspiration is self evident.

Report of the poultry manager, A. G. GILBERT (*Canada Exptl. Farms Rpt. 1894, pp. 228–251*).—The importance of poultry from an agricultural standpoint is pointed out and discussed.

Food.—The fact is emphasized that hens require the same sort of food as dairy cows, that is, food rich in nitrogen. If carbohydrates are fed in excess the hens become fat and will not lay well. The following are recommended as useful poultry foods: Cows' milk, barley middlings, buckwheat bran, barley bran, rye bran, coarse wheat bran, cotton seed, millet, wheat, turnips, cabbage, white clover, red clover, and alsike. Cut green bones are also considered valuable. If they are not easily obtainable cooked meat (liver, lungs, etc.) may be substituted. Green foods of some sort are also necessary and cut clover hay is recommended. Six rations are given in detail.

Feeding experiment.—During the winter, from January 1, a large number of hens were fed in the morning a ration consisting of a warm mash of ground wheat, barley, oats, rye, and bran. Boiled potatoes, steamed and cut clover hay, and cut green bones were occasionally fed. When cut green bones were fed for the morning ration the mash was omitted. Some vegetable foods, either carrots, turnips, or cabbages, were also fed from time to time and plenty of grit was supplied. Grain was scattered in the pens so that the hens had to search for it. There were 75 or 80 layers, and they produced during January 777 eggs, February 791, and March 1,644.

As in previous years, the best layers were found to be Black Minorcas, Andalusians, Plymouth Rocks, Langshans, Brahmas, and Wyandottes. The White Leghorn Brahma and the Langshan-Black Minorca crosses made excellent layers.

Breeding experiment.—Early in March the different breeds were mated for breeding. The eggs of the White Plymouth Rocks were remarkably fertile from the first, though they were from pullets which had laid well all winter. "The development of the chickens was much the same as in previous years, the White and Barred Plymouth Rocks taking the lead with a development of 1 lb. per month without any forcing beyond regular feeding and care, but no more than every chicken should receive."

Some cross-breeding experiments were also made and some promising poultry was obtained. The experiments will be continued. An incubator was experimented with, but owing to the unfavorable situation the results were not very satisfactory.

Loss of weight of eggs during incubation.—The eggs of Black Minorcas and Indian Game-Brahmas were weighed at the beginning of the incubation period and again 21 days later. The first sort lost, on an average, 15.7 per cent in weight, and the second sort 10.8 per cent.

Diseases of poultry.—Impure drinking water and food are, in the author's opinion, common causes of disease among poultry. Poultry diseases are discussed at considerable length, and several cures for roup and colds are suggested.

Cuts and detailed descriptions of 9 varieties of poultry are given.

Investigation of feeding stuffs, 1882-'93 (*Wisconsin Sta. Rpt. 1893, pp. 272-283*).—This consists of abstracts of the following articles previously published by the station: Analysis of freshly cut cornstalks and corn silage (Second Amber Cane Rpt. 1882, p. 81); feeding standards and composition of feeding stuffs (Wis. Sta. An. Rpts. 1886 and 1887, pp. 77, 99); analysis of feeding stuffs (Wis. Sta. An. Rpt. 1886, p. 86); structure of the wheat grain and of wheat bran (Wis. Sta. An. Rpt. 1886, p. 89); analyses of feeding stuffs (Wis. Sta. An. Rpt. 1887, p. 108); analyses of fodder corn and corn silage (Office Expt. Sta. Bul. 2, pt. 1, p. 209); composition of feeding stuffs (Office Expt. Sta. Bul. 2, pt. 1, p. 215; E. S. R., 2, p. 436; 4, p. 176; 5, p. 499); weights and composition of the different parts of the corn plant (E. S. R., 2, p. 431); analyses of feeding stuffs (E. S. R., 4, p. 274); on the valuation of concentrated feeding stuffs (E. S. R., 4, p. 173); notes on forage plants (Office Expt. Sta. Bul. 2, pt. 1, p. 211); yield and composition of different silo corns (E. S. R., 2, p. 430); prickly comfrey *vs.* red clover (E. S. R., 2, p. 435); losses of hay due to weathering (E. S. R., 2, p. 435); Indian corn for forage and for field corn (E. S. R., 2, p. 449); the ensiling of fodders (Experiments in Amber Cane and the Ensiling of Fodders, 1881, p. 60); observations upon the construction of silos and the use of silage (Second Amber Cane Rpt., 1882, p. 87); comparison of shocking and ensiling corn (Office Expt. Sta. Bul. 2, pt. 1, p. 206); ensiled corn *vs.* matured dry corn (Office Expt. Sta. Bul. 2, pt. 1, p. 208); notes on silage (Office Expt. Sta. Bul. 2, pt. 1, p. 209); comparison of ensiling and shocking fodder corn (E. S. R., 2, p. 430); comparison of ensiling and field curing Indian corn (E. S. R., 2, p. 449); losses in ensiling and field curing Indian corn (E. S. R., 4, p. 145).

Composition of feeding stuffs, F. W. WOLL (*Wisconsin Sta. Rpt. 1893, pp. 288-299, chart 1*).—A reprint from the Annual Report of the station for 1892, pp. 311-325 (E. S. R., 5, p. 199).

Results of analyses of fodders and feeding stuffs, C. D. WOODS (*Connecticut Storrs Sta. Rpt. 1894, pp. 17-25*).—Analyses are given of the following fodders and feeding stuffs, used in connection with the experiments of the station: Orchard grass, tall meadow fescue, timothy, barley, barley and peas, cowpea vines, crimson clover, corn silage, fodder (mostly stover), corn stover, oat hay, hay (early cut), hay from mixed grasses, oats and peas, corn meal, corn-and-cob meal, wheat bran, wheat middlings, linseed meal, cotton-seed meal, Chicago gluten meal, cream gluten meal, Peoria gluten feed, and sheep feed. The samples are described in detail.

Feeding experiments with calves and steers, 1882-'93, W. A. HENRY (*Wisconsin Sta. Rpt. 1893, pp. 55-63*).—This consists of abstracts of the following accounts of experiments previously reported by the station: Will it pay to raise the calves of cheese cows for beef (Wis. Sta. An. Rpt. 1886, p. 25); cost of making beef from dairy stock (Wis. Sta. An. Rpt. 1887, p. 11); feeding waste products of the dairy (Wis. Sta. An. Rpt. 1887, p. 21); feeding hay and silage to calves (Second Amber Cane Rpt. 1882, p. 81); steer feeding experiments (Wis. Sta. An. Rpt. 1887, p. 56); feeding silage alone to steers and heifers (Second Amber Cane Rpt. 1882, p. 83); silage for steer feeding (Office Expt. Sta. Bul. 2, pt. 1, p. 205); steer feeding experiments (Office Expt. Sta. Bul. 2, pt. 1, p. 209).

Feeding and digestion experiments with milch cows, 1882-'93 (*Wisconsin Sta. Rpt. 1893, pp. 64-95, pl. 1, figs. 2*).—Abstracts of the following experiments previously reported by the station: Cornstalks compared with mixed hay and clover hay for producing milk and butter (Wis. Sta. An. Rpt. 1886, p. 11); cut *vs.* uncut cornstalks (Wis. Sta. An. Rpt. 1886, p. 9); experiments with corn fodder (Wis. Sta. An. Rpt. 1887, p. 34); the relative value of dry fodder corn and silage as food for milch cows (Second

Amber Cane Rpt. 1882, p. 71); corn silage *vs.* fodder corn for milk and butter production (Wis. Sta. An. Rpt. 1887, p. 25); corn silage *vs.* dry fodder corn for producing milk and butter (Office Expt. Sta. Bul. 2, pt. 1, p. 192); silage *vs.* fodder corn for milk production (Office Expt. Sta. Bul. 2, pt. 1, p. 196); corn silage *vs.* dry fodder corn for milk and butter production (E. S. R., 2, p. 429); digestibility of fodder corn and corn silage (E. S. R., 2, p. 429); silage *vs.* fodder corn for milk and butter production (E. S. R., 2, p. 430); corn silage *vs.* dry fodder corn for milk and butter production (E. S. R., 2, p. 440); the relative value of corn silage and field-cured fodder corn for milk and butter production (E. S. R., 4, p. 178); composition and digestibility of feeding stuffs (Wis. Sta. An. Rpt. 1885, p. 67); value of cotton-seed meal and malt sprouts as feed for milch cows (Wis. Sta. An. Rpt. 1885, p. 78); value of new process oil meal as compared with corn meal for milk production (Wis. Sta. An. Rpt. 1886, p. 97); farmers' experiments on the value of oil meal compared with corn meal (Wis. Sta. An. Rpt. 1886, p. 111); feeding value of roller bran (Wis. Sta. An. Rpt. 1887, p. 113); ground oats *vs.* wheat bran for milk and butter production (E. S. R., 2, p. 440); feeding corn smut to milch cows (Rpt. Regents Univ. Wis. 1881, p. 50); clover silage as a partial food for cows (Wis. Sta. An. Rpt. 1886, p. 17); soiling *vs.* pasturing for dairy cows (Wis. Sta. An. Rpt. 1886, p. 19); on the economy of ensiling Indian corn, "ears and all" (E. S. R., 5, p. 500); comparative value of warm and cold water for milch cows (E. S. R., 2, pp. 430 and 445); chemical compounds for preventing the growth of horns on cattle (E. S. R., 4, p. 187); rations for dairy cows (E. S. R., 4, p. 740); variation in the weight of farm animals (Wis. Sta. An. Rpt. 1886, p. 38); dehorning cattle (Wis. Sta. An. Rpt. 1887, p. 19); on the effect of dehorning milch cows on the production of milk and butter (Office Expt. Sta. Bul. 2, pt. 1, p. 211); on the influence of the nutritive ratio upon milk production (Wis. Sta. An. Rpt. 1887, p. 147); the value of manure from stock on the farm (Wis. Sta. An. Rpt. 1887, p. 28).

Sheep feeding experiments, 1890-'93, W. A. Henry and J. A. Craig (*Wisconsin Sta. Rpt. 1893, pp. 92-115, pl. 1, figs. 4*).—This consists of abstracts of reports of the following experiments which have previously been published in the Annual Reports of the station: Feeding milk to lambs (E. S. R., 2, p. 136); rations for fattening lambs (E. S. R., 2, p. 137; 4, p. 184); feeding grain to lambs (E. S. R., 5, p. 503); fall shearing lambs before fattening (E. S. R., 4, p. 184; 5, p. 504); winter rations for breeding ewes (E. S. R., 4, p. 182); cross breeding Shropshires and Merinos (E. S. R., 4, p. 187; 5, p. 504).

Experiments in pig feeding, 1882-'93, W. A. Henry (*Wisconsin Sta. Rpt. 1893, pp. 10-54, pls. 2*).—These experiments have been chiefly along the following lines:

"(1) A study of the amount of food required for a given gain with young pigs before and immediately after weaning.

"(2) The amount of modification which the flesh and bones of the hog may undergo when supplying or withholding certain food articles.

"(3) The amount of food required for a given gain with maturing hogs.

"(4) The effect of preparation of food on gain."

Abstracts are given of the following articles which have previously been published in the reports of the station: Experiments with pigs before and after weaning (E. S. R., 2, p. 128); cost of feeding pigs before and after weaning compared (E. S. R., 2, p. 138); feeding for fat and for lean (Wis. Sta. An. Rpt. 1887, p. 83); effect of corn-meal shorts and skim milk on the carcass and internal organs of the hog (Office Expt. Sta. Bul. 2, pt. 1, p. 209); effects of dried blood, pea meal, and corn meal on the carcass, bones, and viscera of hogs (E. S. R., 2, p. 426); feeding for fat and for lean (E. S. R., 2, p. 437); effects of rain water, well water, and bone meal on the growth of carcass and strength of bones of pigs (E. S. R., 2, p. 427); bone meal *vs.* hard-wood ashes with corn meal for hogs (E. S. R., 2, p. 301); effect of feeding bone meal and hard-wood ashes to hogs living exclusively on corn (E. S. R., 2, p. 438); feeding sweet skim milk to pigs (Rpt. Regents Univ. Wis. 1881, p. 54); skim milk for mature hogs *vs.* growing hogs (E. S. R., 2, p. 427); sweet skim milk *vs.* buttermilk for pigs (Wis. Sta. An. Rpt. 1887, p. 24); the feeding value of whey (E. S. R., 3, p. 48); corn meal and

skim milk for pigs (Office Expt. Sta. Bul. 2, pt. 1, p. 209); skim milk and corn meal for pig feeding (Office Expt. Sta. Bul. 2, pt 1, p. 209); whole corn *vs.* corn meal for hogs (Office Expt. Sta. Bul. 2. pt. 1, p. 209); feeding corn alone to hogs (Wis. Sta. An. Rpt. 1886, p. 35); corn meal, shorts, and a mixture of the two as a food for pigs (Wis. Sta. An. Rpt. 1886, p. 33); corn and shorts as food for hogs (Wis. Sta. An. Rpt. 1886, p. 35); whole oats *vs.* ground oats for hogs (E. S. R., 2, p. 427); ground barley for fattening hogs (E. S. R., 2, p. 439); sorghum sirup skimmings as a food for pigs (Second Amber Cane Rpt. 1882, p. 35); sorghum seed as a pig feed (Wis. Sta. An. Rpt. 1884, p. 27); cooked *vs.* uncooked food for swine (Wis. Sta. An. Rpts. 1886 and 1887, pp. 36 and 64); cooked potatoes for fattening hogs (E. S. R., 2, p. 439); wet *vs.* dry feed for hogs (Office Expt. Sta. Bul. 2, pt. 1, p. 209); summary of pig feeding experiments at the station, 1883-'88 (Office Expt. Sta. Bul. 2, pt. 1, p. 108); relation between weight of hogs, gain made and food required for 100 lbs. of gain (E. S. R., 2, p. 428); length of intestines of hogs (E. S. R., 2, p. 428); practical conclusions drawn from experiments in pig feeding, 1883-'89 (E. S. R., 2, p. 428).

Amount of fat, sugar, and tannin in coffee, E. HERFELDT and A. STUTZER (*Ztschr. angew. Chem., 1895, pp. 469-471; abs. in Jour. Chem. Soc., 1896, Jan., p. 63*).

Outlines for the Codex alimentarius austriacus, V, a (sugars) (*Ztschr. Nahr. Untersuch. und Hyg., 9 (1895), No. 23, p. 357*).

The proteids of wheat, M. O'BRIEN (*Ann. Bot., 9 (1895), No. 36, pp. 543-548*).

Bread: Vol. I. Physiology, composition, hygiene; Vol. II. Technology, different kinds of bread, adulterations, GALIPPE and BARRE (*Le Pain: Vol. I. Physiologie, Composition, Hygiène; Vol. II. Technologie, Pains diverse, Altérations; 2 vols. of l'Encyclopédie des Aide-Mémoire. Paris: Masson and Gauthier-Villars*).

Flour and bread, C. DESPROCHER (*Rev. Sci., ser. 4, 5 (1896), No. 3, pp. 76-79*).—This is a popular article; among other topics the different parts of the wheat kernel and methods of milling are discussed.

Chronic poisoning due to coffee (*Rev. Sci., ser. 4, 5 (1896), No. 2, p. 55*).—A short summary of the subject based on the investigations of Guelliot, and Gilles de la Tourette and Gasne.

Coffee plantations and coffee, E. JARDIN (*Le Caféire et la Café. Paris: Leroux, 1895, pp. 413*).

On the normal occurrence of iodin in the animal body, E. BAUMANN (*Ztschr. physiol. Chem., 21, No. 4, pp. 319-330*).

The red spotted cattle of the lower Rhine (*Deut. landw. Presse, 23 (1896), No. 11, p. 85, figs. 2*).—This breed is found in the lowlands of the lower Rhine as far as the border of Holland. They resemble in type and characteristics the Normandy breed. They are bred for milk and for beef, the full-grown cow giving in a milking period 4,000 to 4,500 liters of milk with a fat content of 3.2 to 4 per cent, some yielding 6,000 to 7,000 liters. Full-grown fattened steers reach a live weight of 1,200 to 1,400 lbs. at 2½ years. The special excellencies of this breed are, easy keeping, a large yield of rich milk, early maturity, and great feeding capacity, producing a large amount of fine grained meat well mottled with fat. In the lower Rhine cities and in Brussels this meat is preferred to that of all other breeds.

The cattle of Finland, G. GROTENFELT and R. GRIPENBERG (*Deut. landw. Presse, 23 (1896), No. 13, pp. 105, 106, figs. 4*).

Effect of oat straw on the yield of milk (*Braunschw. landw. Ztg., 66 (1896), No. 3, p. 11*).

Feeding milch cows with fodder beets, K. FEDERSEN and G. ZIRN (*Fühling's landw. Ztg., 45 (1896), No. 1, pp. 29-31*).

Feeding potatoes to cattle and sheep, D. ZOLLA (*From Rev. Agr. Jour. des Debats; Fühling's landw. Ztg., 45 (1896), No. 1, pp. 27-29*).

The temperature of horse stalls (*Deut. landw. Presse, 23 (1896), No. 13, p. 103*).—The author regards 59° F. as the desirable average temperature for working horses for the cold part of the year; for mares, suckling colts, and colts, 63 to 66° F. When a horse is very warm on coming into the stable, blanket him and wait until the hair is dry before taking off the harness and blanket.

The horse and his ancestry, M. P. MÉGUIN (*Le Cheval et ses races. Histoire des races à travers les siecles et races actuelles. Vincennes: L'Eleveur, 1895, pp. 487, ills. 74*).

Origin of the fat-tailed sheep, H. MARÈS (*Bul. Agr. Alg. et Tunisie, 1 (1895), No. 1, pp. 11-15*).—The author considers this breed as purely artificial and accounts for its singular characteristics by the desire to supply through the sheep the fat necessary for a healthy diet, since the Mohammedan religion prohibits using the fat of pork.

Sheep raising in Algeria, A. BOJOLY (*Bul. Agr. Alg. et Tunisie, 1 (1895), Nos. 4, pp. 88-95; 5, pp. 111-115*).

Breeds of sheep in Kabylia, M. A. FLEURY (*Bul. Agr. Alg. et Tunisie, 1 (1895), No. 2, pp. 39-43*).

Zebus, SAINT-JAMES (*Bul. Agr. Alg. et Tunisie, 1 (1895), No. 15, pp. 350-354*).—Treats of the successful crossing of zebus with native cattle at Rio Janeiro, Brazil, and in Algiers, and of attempts made in this line in European countries.

VETERINARY SCIENCE AND PRACTICE.

Tuberculosis at the branch experimental farms, W. SAUNDERS (*Canada Exptl. Farms Rpt. 1891, pp. 58-71*).—This is a report on a series of injections with tuberculin at several branch farms. At the farm at Brandon, Manitoba, 21 animals out of 28 were found to respond to the injection; at Indian Head, Northwest Territory, 13 out of 39; at Nappan, Nova Scotia, 10 out of 39, and at Agassiz, British Columbia, 5 out of 18.

The animals which exhibited a considerable rise of temperature upon the injection of tuberculin were all slaughtered, and without exception proved, upon *post-mortem* examination, to be affected with tuberculosis. Notes are given on the *post mortem* anatomical appearance of each animal slaughtered. Tables are included showing the temperature record of each of the animals, sound and diseased. The grade animals appeared to be less subject to tuberculosis than those of pure breed, and the Holstein and Ayrshire breeds seemed to be less susceptible than other breeds.

This series of investigations makes a total of 74 *post-mortem* examinations that the experimental farms have made on the value of temperature response to tuberculin injection, with the result that tuberculosis was found present in every case, although in 26 of the animals the lungs were not affected.

Tuberculosis and its prevention, F. P. WILLIAMSON and F. E. EMERY (*North Carolina Sta. Bul. 117, pp. 201-214*).—A general discussion of the tubercle bacillus, of the prevalence of tuberculosis, and of preventive measures; and temperature records and notes on 2 small herds tested with tuberculin. As a result of the tuberculin test 1 animal was slaughtered, but neither *post-mortem* nor microscopic examination revealed anything suspicious. In the case of 1 cow there were found black hulls of cotton seed in the larger bronchi.

Epidemic abortion of cows, E. NOCARD (*Ind. Lait., 20 (1895), No. 46, pp. 361, 362*).

The employing of serum against anthrax, A. SCLAVO (*Centbl. Bakt. und Par. Med., 18 (1895), No. 24, pp. 744, 745*).

Contagious inflammation of the udder of cows, J. CHRISTENSEN (*Maanedsskr. Dyrläger, 7 (1895), pp. 102–108*).—Cases and treatments cited.

Contagious pleuro-pneumonia, ARLOING (*Jour. Agr. Prat., 59 (1895), No. 47, pp. 734–737*).—A program for inoculating experiments.

Researches on the pneumobacillus of Friedländer, L. GRIMBERT (*Ann. Inst. Pasteur, 9 (1895), No. 11, pp. 840–853*).

Poisoning of horses by golden-rod, J. L. SCOTT (*Garden and Forest, 8 (1895), No. 405, pp. 477, 478*).—A report is given of the death of a number of horses, the cause attributed being either some principle of the plant or some fungus contained by it. The species of golden-rod is not mentioned.

Ringworm of calves, G. T. BROWN (*Jour. Roy. Agl. Soc. England, 6 (1895), No. 22, pp. 308–326, figs. 5*).—A general account of this disease, with special reference to the fungus, *Trichophyton tonsurans*, that causes it. Remarks are made on infection, the symptoms, pathology, and treatment, washing with warm soapsuds, followed by the application of chlorid of zinc, sulphurous acid, and glycerin being recommended.

Tuberculosis in cattle, C. S. PLUMB (*Breeders' Gaz., 1895, Dec. 11, p. 424*).—An abstract of an article by B. Bang on "The struggle with tuberculosis in Denmark."

Tuberculin as a diagnostic agent, GUTMANN (*Monat. prakt. Tierheilkunde, 6, No. 10, pp. 433–441; abs. in Centbl. Bakt. und Par. Med., 18 (1895), No. 25, pp. 788–790*).

An American blood test for cattle tuberculosis, E. CUTTER (*New York: Author*).

Diphtheria of poultry, H. GEORGE (*Jour. Agr. Prat., 59 (1895), No. 52, pp. 913, 914*).—Description of the disease, with methods of treatment and disinfection.

Notes on parasites, C. W. STILES and A. HASSALL (*Centbl. Bakt. und Par. Med., 19 (1896), No. 2–3, pp. 70–72*).—Notes are given of *Ctenotænia denticulata*.

Bacterial diseases of animals, E. NOCARD and E. LECLAINCHE (*Les maladies microbiennes des animaux. Paris: G. Masson, 1896, pp. 816; abs. in Centbl. Bakt. und Par. Med., 18 (1895), No. 24, pp. 755, 756*).

Effect of acids and of bedding impregnated with acids on the bacteria of contagious animal diseases, A. STUTZER, R. BURRI, and E. HERFELDT (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 24, pp. 841–854*).

On the relation of veterinary medicine to human medicine, O. MALM (*Maanedsskr. Dyrläger, 7 (1895), pp. 11–39*).—A historical sketch. The aim of the author is to show that "veterinary medicine has taken an honorable part in scientific work, and that economically far reaching and important scientific facts have been secured for mankind through the veterinary medicine and veterinarians."

Report of the Royal Swedish Veterinary Institute for 1894 (*Tidskr. Vet. Med. och Husdjurskj., 14 (1895), pp. 65–101*).

DAIRYING.

Investigations on the origin of the glycerids in the volatile acids in the fatty matter extracted from milk, G. CUGINI (*Staz. Sper. Agr. Ital., 28 (1895), No. 8, pp. 530–541*).—The udder of a cow killed 5 months after the last milking was boiled with distilled water for 2 hours. After cooling, the layer of fat, albumen, and gelatin on the surface of the liquid was melted and filtered hot; 5 gm. of the filtrate gave 0.66 volatile fatty acids by Wollny's method.

In regard to subjecting the tissue of the udder to artificial digestion the author says:

"If it is true that the formation of milk in mammalia is due to the dissolution of the mammary gland, and if it is also true that the different constituents of this

animal liquid are generated during the metamorphosis of the glandular tissue, we think by subjecting the said tissue to artificial digestion with the object of studying afterwards the fatty matter extracted . . . it should give, as the product of the chemical transformations, the same constituents which are found in milk, and among them the glycerids of the fatty matter and of the volatile acids."

About 600 gm. of the glandular tissue of the udder of a cow 4 months dry and just killed was reduced to fine pieces. Part of this was digested at 34 to 40° C. for 24 hours with a 2½ per cent solution of pepsin. The decanted liquid was evaporated to dryness with the addition of a small amount of caustic soda and extracted with ether: this extract gave for the Wollny number 5.17. The Wollny number for the extract from the undigested portion was 0.77. The author states that the number found after artificial digestion is much higher than any yet determined for the fatty matter from the different parts of the body of the cow.

"Artificial digestion, therefore, in dissolving the glandular tissue of the cow's udder is analogous in effect to the disaggregation of the glandular cells with degeneration of the fatty matters, and gives the same products of decomposition, the glycerids of the volatile fatty acids."

The author shows from some previous experiments that the fat of the colostrum before and immediately after parturition contains the following quantities of volatile fatty acids expressed in Wollny numbers:

Volatile fatty acids in colostrum.

Cows.	Hours before parturition.	Hours after parturition.		
	3	6	12	30 to 36
	Wollny number	*Wollny number*	*Wollny number*	*Wollny number*
Vignola	4.73	6.27	......	[1] 17.82
Goldau	4.40	6.16	11.22	[2] 18.87

[1] After 30 hours. [2] After 36 hours.

"The small quantity of volatile acids at the beginning of active secretion of the udder as the above numbers show, at least the rapid increase of the same, reaching in a few days a maximum (39.61), to go back again to the normal number (31.68), as took place with the cow Goldau, are a new confirmation of what Voit and other physiologists admit; that is, that the first transformations of the contents of the glandular cells of the cow's udder take place slowly, reaching afterwards a maximum with greater activity of secretion to fall back within the limits in normal milk."

The author divides milk-giving animals into 2 classes with reference to their ability to produce the glycerids of the fatty acids. Those with a high Wollny number are sheep, 32.89; goat, 28.60; cow, 27; buffalo, 26.18; rabbit, 16.06; ass, 13.09; and horse, 11.22. Those with a low number are the cat, 4.40; rat, 2.97; sow, 1.65; woman, 1.42; and bitch, 1.21.

A mongrel Newfoundland bitch 2 years old, for 15 days before and 15 days after parturition was fed twice a day on an exclusively vege-

table diet. Fifteen days after parturition the average of 2 determinations of the volatile acids in the milk gave 1.375 for the Wollny number, which is but slightly above 1.21 found with a meat diet. The author believes this to show that the milk-giving organ is of more importance than the food, and that in the different breeds of animals, having different powers of production of the glycerids of the volatile fatty acids, these powers can in no manner be modified. The author shows that green meadow hay and green clover had a higher content of the volatile acids than the same when dry, and believes that this will account for the larger amount of the volatile acids in the milk from fresh fodder.

"In animals with a great milk production, as the cow, fed . . . with very rich fresh fodder the glycerids of the fatty acids may escape unaltered during the digestive process, just as, with as much probability, we believe other unaltered constituents contained in it do pass through."

Changes in the physical properties of milk between the addition of rennet and coagulation, E. GUTZEIT (*Milch Ztg., 24 (1895), No. 46, pp. 745, 746*).—The author reports 3 experiments on this point. The milk was skimmed with a separator, filtered through glass wool. 5 per cent of rennet solution added, and the viscosity determined at frequent intervals for about an hour. The temperature was 15° C. in the first experiment, 20° C. in the second, and 30° C. in the third. The conclusions reached are as follows:

(1) The specific gravity of the milk does not change under the action of rennet so long as there is no separation into curd and whey.

(2) The viscosity of milk begins to increase immediately on the addition of rennet.

(3) As is known, the strength of the rennet solution and the height of the temperature are, within certain limits, inversely proportional in their action on curdling, and by changing both factors proportionally may be varied without changing the time required for curdling.

Under these conditions, with stronger rennet solution (and lower temperature) the viscosity increases very noticeably at first but later in the process relatively little; while with very dilute rennet (and higher temperature) the viscosity increases very little at first but rapidly later.

Some observations of the number of bacteria in dairy products, A. E. LOVELAND and W. S. WATSON (*Connecticut Storrs Sta. Rpt. 1894, pp. 69-76*).—The authors summarize investigations made elsewhere on the number of bacteria in milk and give the results of determinations made on the milk delivered to customers in Middletown, Connecticut, together with the method employed.

The sweet milk was less than 1 day old, usually from 3 to 6 hours old. The number of bacteria per cubic centimeter of milk varied from 11,000 to 8,452,000. The highest number was found in milk which had been drawn the night before delivery. Milk of the night before contained 3,424,000 and 8,452,000 germs, while the fresh morning's milk from the same source contained 99,000.

"The average in the 18 tests made is a little less than 1,000,000 per cubic centimeter (990,000). But if the average is taken without including 2 samples which were probably night's milk, the average is reduced to less than 100,000 germs per cubic centimeter. . . .

"The number of bacteria in milk as ordinarily sold may vary from thousands to millions per cubic centimeter. The smallest number found in milk sold in Middletown was 11,000 per cubic centimeter and the largest number was nearly 8,500,000. As there are 946 cc. in a quart, these figures mean that the milk had from 10,000,000 to 8,000,000,000 bacteria per quart.

"The presence of only a small number of bacteria in milk indicates care and cleanliness in its handling and storage, and also that it is comparatively freshly drawn. Sour milk and ripened cream contain many millions of bacteria in a cubic centimeter."

The bacteria in 10 samples of curdling milk from 2 to 7 days old and in 2 samples of ripening cream are also given.

An investigation was made of the bacteria in butter, using 2 lots each of salted and unsalted creamery butter. The tests commenced as soon as the butter was made and continued for about a month in each case. At intervals samples were taken from the inside of the mass of the butter ball as well as the outside. The freshly made butter usually contained from 10,000,000 to 50,000,000 bacteria per gram, although in one instance over 100,000,000 were present.

"There is a constant decrease in the number of bacteria as the butter becomes older. In general this decrease is most marked at the very outset. In the case of the first lot of unsalted butter 65 per cent of all the bacteria present died off in the first day. Ripened cream contains immense numbers of germs, hence it would be expected that freshly churned butter would also contain large numbers. After a number of days the number of bacteria are in general smaller in the inner than in the outer portions of the butter. . . .

"The decrease in salted butter is much greater in the first few hours than that of unsalted butter."

Two samples of salted butter a year old contained 109,000 and 149,000 bacteria per gram, respectively.

Cream ripening with pure cultures of bacteria, H. W. CONN (*Connecticut Storrs Sta. Rpt. 1894, pp. 77-91*).—This is a continuation of work reported in the Annual Report of the station for 1893 (E. S. R., 6, p. 478) in testing the effect of different bacteria in ripening cream. In the present paper a description is given of 17 different forms, obtained from various sources, together with the results of experiments in ripening cream with them. Trials are also given with 6 other species of bacteria isolated from water. In each case a number of experiments were made, in most cases 8 or 10, and "in all cases enough to bring about uniform results." Of the species tried only 4 were regarded as advantageous to butter making, although a number were neutral in their effect.

"These experiments are still in progress, and it appears best to defer a summary and discussion of them until a later period, when other experiments can be published in detail. It may perhaps be well, however, to notice the relation of the species experimented with up to this time to the power of producing lactic acid. The phenomena which is in this vicinity called 'ripening' is frequently called 'souring,'

and is practically always accompanied in normal butter making by the production of lactic acid. It will be seen, however, from the various experiments already published, that the souring of the cream is only one of the phenomena, and that the production of a proper butter flavor is dependent upon some changes entirely independent of the formation of lactic acid. The fact that in some cases the bacteria do not produce the same reaction in the cream as in sterilized milk is doubtless due to the uncertainties of pasteurization. Of the 29 species of bacteria whose effect upon butter has been described in this paper and in the previous report, 10 produce acid in milk and cream, and therefore sour the cream. Of these, only 2 make what has been regarded as good butter. Five have been found to make milk and cream slightly acid without souring it to any noticeable degree. Of these, 2 produce good butter. Twelve either have no effect on the butter or render it slightly alkaline, and of these, 1 produce good butter. On the other hand, at least 4 of the acid species produce decidedly bad butter, and of the species producing an alkaline reaction 5 produce bad butter. All of the other species produce little or no appreciable effect on the butter. Of all the species thus far studied, the one producing the best results and the most desirable aroma in the butter was No. 41, which, while producing a little acid, does not appreciably sour the milk or cream, and never either curdles it or even renders it thicker than usual. The experiments, therefore, thus far indicate that the butter aroma has nothing to do with the production of lactic acid."

Experiments in ripening cream with Bacillus No. 41, H. W. CONN (*Connecticut Storrs Sta. Rpt. 1894, pp. 57–68*).—The description of *Bacillus No. 41*, previously given in Connecticut Storrs Station Bulletin 12 (E. S. R., 5, p. 996), is repeated, and the method of experiment explained. Experiments were begun in November, 1893, at a creamery at Cromwell, Connecticut, pure cultures being sent to the creamery from time to time for use in ripening the cream.

"In each case there was an improvement in the butter, and the experiment was continued for 3, 4, 5, or 6 weeks, until the butter maker noticed a distinct deterioration in the quality of his butter. Then a new culture was sent to the creamery, which immediately restored the quality to the butter.

"At 4 distinct periods the butter from the creamery was sent to an expert for rating, together with a lot of butter made from half of the same cream of the same day, but without the artificial inoculation. In every case where the butter was thus sent the butter made by the artificial culture was rated higher than the butter made without it. It was marked from 1 to 15 points, on a scale of 100, ahead of the normal butter, the improvement being chiefly in the flavor. In one case the inoculated butter was 18 points ahead of the uninoculated butter. In another case 3 lots were sent to the expert, one made with a culture of *Bacillus No. 41*, a second made with the artificial culture sold by Carl Hansen's dairy company, and a third lot by a combination of *Bacillus No. 41* and Carl Hansen's ferment. The butter made from *Bacillus No. 41* rated highest, 95 points, the combination next, 83 points, and Carl Hansen's lowest."

An experiment made in June, when the butter made with uninoculated cream was of excellent quality, showed the beneficial effects of *Bacillus No. 41*, the aroma being "more pronounced and more agreeable than that of butter made without inoculation."

Trials at over 60 creameries in Connecticut, and in Pennsylvania, Indiana, and Iowa are also cited.

"With a single exception none of this large series of creameries has failed to report an improvement in their butter. The creamery which did not find such improvement was reported as failing to have proper care for cleanliness in its butter-

making process, and the failure to find an improvement has not therefore been thought to be significant."

Some doubt was entertained as to whether the culture could be used in private dairies where the cream has accumulated for a number of days before being churned. A trial was made at a dairy which was troubled with the appearance of "curds" in the butter.

"The curds disappeared in the butter that was ripened by the artificial culture, and everyone to whom the butter was submitted stated that it was decidedly superior to the butter that had been made previously. The experiments were not continued in this dairy for any length of time, and the butter immediately fell off again in quality."

Two other trials in private dairies showed the butter to be slightly improved in one case and decidedly improved in another by the use of the artificial culture.

"So uniform have been the results of the use of this organism that it must be regarded now as beyond the reach of experimentation, and *Bacillus No. 41* takes its rank as a species of organism whose artificial use in the ripening of cream will produce a striking improvement in the flavor of the butter. The effect of the culture upon the various grades of butter is not exactly what might have been expected, and I have been considerably surprised thereby. When the experiments were begun I had supposed it probable that the use of the artificial culture might improve a poor quality of butter, but was very doubtful whether it would have any effect, at least any advantageous effect, upon first-class butter. Experiments, however, have shown that the organism appears to be of decided value even in first-class creameries. As already mentioned, the effect of the organism appears to be to add to the butter an especially delicate aroma and taste, and this delicate aroma and taste is added equally to butter of a poor grade and medium grade, or to butter of the very highest quality. In the light of the present experiments, therefore, it appears that all grades of butter may be somewhat improved by the use of artificial cultures.

"Another matter of some interest is the fact that *Bacillus No. 41* is not a milk-souring organism. The 'ripening' of cream is in many places called the 'souring' of cream, and it has been supposed by all experimenters hitherto that the souring was identical with the ripening. For this reason all of the species of bacteria which have hitherto been used in ripening cream have been acid-producing organisms. Experimenters have not thought it worth while to investigate whether or not the aroma of butter might not be due to species of organisms that do not normally sour the cream. *Bacillus No. 41*, while it produces a very slight acid reaction, does not sour the cream, and it belongs, therefore, to an entirely different class of organism from those hitherto used. This is especially interesting as indicating that probably the aroma of the butter is entirely distinct from the souring of the cream and may be produced either by acid organisms or by organisms that do not produce acid. . . .

"No previous treatment of the cream is needed in order that *Bacillus No. 41* may produce its appropriate results. This, of course, greatly simplifies the use of the organism and makes it much more probable that artificial inoculation of cream for ripening may in the future become a somewhat universal process."

Comparative tests of pure cultures of bacteria, J. W. ROBERTSON (*Canada Exptl. Farms Rpt. 1894, pp. 86–89*).—In these tests Zoffmann's pure culture of lactic ferment, Chr. Hansen's pure culture of lactic ferment, the Central Experimental Farm culture, and ordinary buttermilk were compared for ripening cream for butter making. The 2 pure cultures were obtained directly from Denmark.

The Central Experimental Farm culture was prepared at the dairy as follows:

"A small quantity, about 2 qts., of skimmed milk was heated to 205° F. The temperature was maintained at that point for 10 minutes, after which, and while exposed to the atmosphere of the butter making room, it was cooled to 80° F. It was left in a closed, glass-stoppered bottle at the ordinary temperature of the dairy room, from 60 to 70° F., for 5 days. It was then found to be coagulated and to possess a mild, pure, lactic-acid flavor, which became more distinct after it had been kept in cold water at a temperature of 40° F. for 3 days. This was the culture."

Five comparative trials were made with the Hansen pure culture and ordinary buttermilk, using 125 lbs. of cream in each case. The cream was ripened at 69 or 70° for 20 hours in case of the pure culture and 14 hours in case of the buttermilk culture. The time of churning, fat left in buttermilk, and quantity of butter made were nearly the same for the lots with different cultures.

After 39 days the butter was scored on the scale of 45 points. The average for that ripened with Hansen's pure culture was 43¾ and that ripened with buttermilk 40¾ points.

Two comparative trials were made with the 2 pure cultures and the Central Experimental Farm culture, using 56 lbs. of cream in each case. The cream was ripened at 72.5° F. for 24 hours in each case. The scoring of the butter on a scale of 45 points at the end of 8 and 48 days was as follows:

Scoring of butter made with different cultures.

	After 8 days	After 48 days
Butter made with—		
Zoffmann's pure culture	41.5	33.5
Chr. Hansen's pure culture	42.5	36.0
Central Experimental Farm culture	44.0	40.5

The following are remarks on the butter at the second time of scoring:

"(1) Zoffmann's culture, 'off' and foul.'

"(2) Chr. Hansen's culture, 'considerably off flavor.'

"(3) Central Experimental Farm culture, 'of a better keeping quality than the others.'"

In addition to the above a number of tests of the different starters at different seasons of the year, 41 tests in all, are summarized, but no scoring of the butter given.

The author's conclusions for all of the trials are as follows:

"The culture of ferments (or bacteria) obtained from a thoroughly clean dairy building, the Central Experimental Farm culture, imparted a more valuable flavor to the butter than the pure culture of lactic ferment from the laboratories of Messrs. Zoffmann and Chr. Hansen.

"A slightly larger quantity of butter was made per pound of butter fat in the cream, and a little shorter period of churning (3 minutes less) was required after the use of the Central Experimental Farm culture, than after the use of the other cultures tested.

"Every butter maker may make a culture of ferments (or bacteria) for the making of a fermentation starter of excellent quality, in his or her own butter-making room, if everything in and about it be kept scrupulously clean.

"The use of a fermentation starter of fine flavor imparts to the butter made from stable-fed cows, and from cows which have been milking for periods of more than 6 months, a flavor of high market value, which is not usually obtainable otherwise."

Churning cream at different stages of ripeness, J. W. ROBERTSON (*Canada Exptl. Farms Rpt. 1894, pp. 89, 90*).—Seventeen trials are reported in which cream was churned sweet or ripened for 12 or 20 hours.

"The ripening of the cream was commenced at a temperature of 80° F. As soon as the cream was at the desired condition of ripeness (*i. e.*, thick and slightly sour) it was cooled to the churning temperature—57° F. One-half of it was churned at once, and the remaining half was left for 8 hours more before it was churned. Four additional tests were made with cream ripened in 12 hours, and this being done in one of the warm months of summer a temperature of 76 proved to be sufficiently high. The sweet cream was kept in ice water to the time of churning. . . .

"From these tests it appears that—

"(1) A slightly greater yield of butter (0.94 of a pound of butter per 100 lbs. of butter fat in the cream) was obtained from cream which was ripened for 20 hours than from cream ripened for 12 hours.

"(2) The butter from the cream which was ripened for 20 hours was slightly richer in flavor, but was of no higher commercial value than that from the cream ripened 12 hours.

"(3) The butter from the cream which was churned sweet was slightly less in quantity (1 1 lbs. and 2.04 lbs. of butter, respectively, per 100 lbs. of butter fat in the cream) than the butter from lots of cream ripened 12 hours and 20 hours, respectively.

"(4) The butter from the cream which was churned sweet was 2 points lower in flavor than that from the ripened cream."

Butter fat vs. space system for paying for cream at creameries, C. D. WOODS (*Connecticut Storrs Sta. Rpt. 1894, pp. 7-16*).—In connection with a feeding experiment in 1890 it was found that the fat content of the cream raised in the Cooley creamer varied quite widely from time to time in the case of the same cows. The greatest variation in the case of a single cow was from 20.82 to 23.3 per cent of fat, the average being 21.66 per cent; in all the tests made the variation was from 18.41 to 23.3 per cent. Subsequently the cream furnished by 24 patrons of the creamery was analyzed and the results, together with other data, are tabulated.

"The percentages of butter fat in the cream of this route ranged from 11 to 24 per cent. The average for the route was 16.9 per cent butter fat. . . .

"That many of the patrons on this route were taking advantage of the way in which the cream was gathered is apparent. It required on the whole route 8.2 spaces of the cream which the patrons drew themselves to make a pound of butter fat, while the average for the whole creamery for the month was 7.7 spaces."

The actual value of the cream per space for butter making when the average price was 3 cts. ranged from 1.7 to 4.6 cts.

Later a comparison of the butter fat and space systems of paying for cream was made at the above creamery during the entire month of April, 1894. The record for 78 patrons for the month is tabulated.

"The total number of spaces collected was 57,011, for which the creamery paid 3 cts. per space, or a total of $1,706.07. The cream contained 7,462.1 lbs. of butter fat, from which 9,023.5 lbs. of butter were made. The average percentages of the butter fat in the cream of the 78 patrons varied from 14.8 to 22.4, while the average of all the cream for the month was 19.6 per cent of butter fat. On the average, 7.6 spaces were required to make a pound of butter fat, and the range was from 6.7 spaces to 9.6 spaces per pound of butter fat.

"[On the basis of 3 cts. per space paid for the cream] some patrons were very decidedly underpaid and others were considerably overpaid during the month. One man would have received $6.87 more for his cream if he had been paid by butter fat than he actually received by the space system.

"[The value for butter making of] each patron's cream when the creamery was paying 3 cts. per space for all the cream used during the month ranged from 2.4 to 3.4 cts. per space.

"As a result of this month's trial the creamery managers voted unanimously to adopt the butter-fat system of paying for cream, and they have been using this method for a year with satisfactory results."

A week's test was made on the cream of 42 patrons of another creamery, the results of which are tabulated.

"The total weight of the 8,814 spaces of cream was 6,661.7 lbs. The average percentage of butter fat in the cream was 18.1; the lowest percentage of butter fat was 14 and the highest 21.75 per cent. . . .

"The value per space of the cream on the butter fat basis ranged from 2.6 cts. to 3.6 cts. per space when the average price paid was 3 cts. per space. This means that 4 patrons each received $3 for each hundred spaces of cream which they furnished, when in reality the cream was worth only $2.60 per hundred; and that at the same time 2 patrons were furnishing cream worth $3.50 per hundred spaces, for which they received only $3 per hundred. In other words, the 2 patrons were each giving 50 cts. per hundred spaces to their neighbors who were producing poorer cream."

The paper concludes with a description of the method of paying for cream on the basis of the fat content and the advantages of this system.

A test of dairy salts, F. L. KENT and F. A. LEIGHTON (*Iowa Sta. Bul. 28, pp. 234-236*).—A lot of freshly churned butter was separated into 6 portions, each portion being salted with a different brand of salt. Otherwise the samples were treated exactly alike. The butter was kept in a refrigerator, and 5 weeks after it was made samples were sent to 2 butter experts in Chicago for scoring. "Each of the tubs had begun to show the effects of keeping somewhat, although not at all rancid," and the judges found practically no difference between the different lots. Later the lots were scored again, but no noticeable difference was found.

Danish butter exhibitions, 1892-'95 (*Tre og tredivte Beretn. Kgl. Vet. og Landbohöjsk. Lab. f. landök. Forsög, Copenhagen, 1895, pp. 36*).—This is the second report of the investigation of samples of butter sent to the permanent butter exhibitions conducted by the Danish State experiment station (E. S. R., 5, p. 721). The present report includes the results of exhibitions Nos. 32 to 70 and gives the average of 4,458 samples of butter—2,457 made during winter and 2,001 during summer.

The butter was scored only once, when 7 to 8 days old, instead of twice, as in previous exhibitions.

Water in Danish butter.—The average water content of the 4,458 samples of Danish creamery butter exhibited was 14.32 per cent; the winter butter contained 14.56 per cent and the summer butter 14.03 per cent. The water content of Danish butter has decreased during the last 5 years, and the average for the whole year is at present about 13.75 per cent. This is shown to be largely due to the gradual disappearance from the market of butter containing over 16 per cent of water.

Relation of quality of butter to its water content.—The data obtained corroborate earlier results in showing that the higher the water content of the butter the lower its average quality, and *vice versa*. When more than 16 per cent of water is found in the butter its quality is greatly lowered.

Leakage of brine.—The conclusion previously drawn that winter butter is more apt to lose brine than summer butter was corroborated. Sixteen per cent of the tubs exhibited lost brine on being stored. There has been a gradual decrease in this percentage from year to year, especially in case of winter butter, due to greater care in manufacture. The loss of brine on standing did not bear any definite relation to the water content of the butter.

The influence on the water content of the time between salting and last working and of the number of workings is shown in the following table, giving the results for 1,279 samples of summer butter and 1,389 of winter butter:

Water content of butter.

Time between salting and last working.	Summer butter			Winter butter			All samples.		
	One working	Several workings	Average.	One working	Several workings.	Average.	One working.	Several workings.	Average
	Per ct	*Per ct*	*Per ct*	*Per ct*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*
Under 6 hours	14.91	14.47	14.60	14.92	14.49	14.60	14.92	14.48	14.60
From 6 to 12 hours	14.40	13.70	13.88	14.51	13.86	13.93	14.43	13.80	13.90
From 12 to 24 hours	13.95	13.05	13.33	13.92	12.92	13.24	13.94	13.02	13.30
Average	14.45	13.82	14.00	14.78	14.27	14.40	14.62	14.07	14.22

About 73 per cent of the butter exhibited had been worked more than once. The water content was decreased by working more than once and by lengthening the interval between salting and last working. Increasing the number of workings and the time between salting and last working diminished the liability to lose brine on standing. The tendency of later years has been to work the butter more than once and to allow a longer time than previously between salting and last working.

The influences affecting the shrinkage of butter on standing are traced in detail in the report, but can not be given here.

Pasteurization of cream in butter factories.—The proportion of the butter exhibited which was made from pasteurized cream has been

steadily increasing during late years. In 1894–'95 it amounted to 44 per cent of the butter exhibited, viz, 28 per cent of the summer butter and 62 per cent of the winter butter. This butter scored, on the average, 0.9 and 1.1 points higher for summer and winter butter, respectively, than that made from cream unpasteurized (on a total score of 15 points), and contained less water in every case.

Cooling of butter.—Experiments conducted by the late Professor Fjord in 1886 showed the importance of prolonged cooling of butter in the creamery and during transportation. Butter from the same churning was divided into two parts, one of which was kept in a refrigerator and the other left in the creamery at ordinary temperature. In 252 trials with butter kept for different lengths of time and under varying conditions, the cooled butter was pronounced better in 214 cases, equally good in 28 cases, and inferior in 10 cases.

A large number of temperature observations were made in the present investigation to study this question. The following table gives a few characteristic cases:

Temperature of butter by cooling and warming.

Observations made.	Tub 1.					Tub 2.				
	Temperature of room.	Temperature of butter.				Temperature of room.	Temperature of butter.			
		In middle.	Two inches in.	Near the wood.	Average.		In middle.	Two inches in.	Near the wood.	Average.
	Deg. C.	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*	*Deg. C.*
	A. Cooling in refrigerator.									
At beginning	5.3	15.3	16.8	16.4	16.0	5.7	17.5	17.2	12.8	15.8
After 4 hours	4.3	15.5	16.0	11.4	14.3	5.1	17.5	16.5	11.2	15.1
After 8 hours	4.3	15.5	14.6	9.4	13.2	5.0	17.0	15.3	10.2	14.2
After 12 hours	4.2	15.3	13.6	8.4	12.4	4.8	16.4	14.2	9.4	13.3
After 24 hours	4.0	13.5	10.5	6.5	10.2	4.7	14.5	11.8	8.1	11.5
After 48 hours	3.8	8.9	7.2	5.0	7.0	4.7	9.9	8.5	6.5	8.3
After 72 hours	3.7	6.3	5.5	4.3	5.4	4.7	7.5	7.0	5.9	6.8
	B. Warmed at ordinary room temperature.					Warmed in heated room.				
At beginning	16.7	6.3	5.5	4.3	5.4	28.0	7.5	7.0	5.9	6.8
After 4 hours	16.8	6.3	6.0	9.8	7.4	27.7	7.5	8.0	15.9	10.5
After 8 hours	17.3	6.2	7.3	11.9	8.5	29.7	7.5	10.3	19.3	12.4
After 12 hours	17.3	6.4	8.4	12.7	9.2	30.0	7.9	12.5	21.2	13.9
After 24 hours	16.5	7.8	11.0	14.1	11.0	30.4	11.1	17.8	24.5	17.8
After 48 hours	17.1	11.6	14.0	16.0	13.9	29.4	17.5	22.5	26.2	22.1
After 72 hours	16.8	13.5	15.0	16.2	14.9	....	....	....	....	....

Even after 72 hours the butter in the middle of tub 1 was 2.6° C. warmer than the room temperature. The rise in temperature in the middle of the tub at the beginning of the cooling, and the fall at the beginning of the warming, was always noticeable, showing the time required for the conduction of heat to or from the inner mass of the butter. A table calculated from experimental data obtained by Professor Fjord is given, showing the approximate temperature of butter in tubs after 4 to 72 hours' cooling or warming.

The bearing of these results on the storage and transportation of butter is evident. "Although the full benefit of cooling butter at creameries will result only when followed by cooling on railroad and steamer, it is nevertheless important for creameries to cool their butter

thoroughly, since it will thereby be able to better resist unfortunate temperature conditions during transportation, and thus always be at an advantage compared with butter not cooled."—F. W. WOLL.

Contributions to the study of the ash of cheese, G. MARIANI and E. TASSELLI (*Staz. Sper. Agr. Ital., 28, p. 23; abs. in Analyst, 20 (1895), July, p. 168*).—The authors give the total ash, chlorin, lime, and phosphoric acid found by them in 15 samples of cheese—Gonzola, Edam, and skim milk. The chlorin was naturally variable, depending upon the salting. There was an excess of phosphoric acid over that required to form tricalcic phosphate, which is attributed by the authors to the probable presence of acid phosphates. The largest quantities of lime and phosphoric acid were found in cheese made from sheep's milk and from sour milk, which indicates that acidity does not prevent the precipitation of calcium phosphate with the curd.

Investigations in dairying, S. M. BABCOCK (*Wisconsin Sta. Rpt. 1893, pp. 116–151, pl. 1, fig. 6*).—This includes a brief history of milk testing and the development of the Babcock test, with a description of the Babcock test reprinted from Bulletin 36 of the station (E. S. R., 5, p. 82).

"In all over 60,000 documents describing the test have been sent out by this station alone, and, besides, the bulletins have been copied in whole or in part by many of the agricultural papers and experiment station publications in this country and in Europe. In spite of the very general distribution of matter relating to this test calls are received almost every day for information regarding it, and it has been thought advisable to reprint it in this report."

A simplified formula is given for the estimation of the total solids in milk from the percentage of fat and the specific gravity (E. S. R., 4, p. 189), a résumé of work by the author on fibrin in milk (E. S. R., 1, p. 61), a discussion of the influences which affect the quality of milk (E. S. R., 2, p. 428), a summary of experiments in creaming milk (Wis. Sta. An. Rpts. 1885 and 1886 and Bulletins 7 and 29; E. S. R., 3, p. 480), and churning tests (Wis. Sta. An. Rpt. 1886 and Office Expt. Sta. Bul. 2, pt. 1, p. 212).

Milk records at the experiment farm, F. E. EMERY (*North Carolina Sta. Bul. 116, pp. 185–193, fig. 1*).—The method of keeping a record is described and condensed summaries given of the record of the station herd from 1891 to 1894, inclusive, with general remarks on the feeding, and comments on the results with the different cows.

Pasteurization and milk preservation, with a chapter on selling milk, J. H. MONRAD (*Winnetka, Illinois: Published by the author, 1895, pp. 80, pl. 1, figs. 70*).—This little pamphlet discusses in a popular manner the pasteurization of milk, cream, and skim milk on a commercial scale and for home use. The principles of pasteurization are explained; the principal forms of apparatus for pasteurizing and cooling milk, including the more recent European and American inventions, are illustrated and described; and remarks are made on the bottling of milk, transportation, etc.

The author shows much familiarity with the practical work in this line which is being done in this country and abroad. He gives some sound advice on cleanliness in the stable, the care of dairy utensils and apparatus, and urges the greatest care in all details if pasteurizing on a commercial scale is undertaken. In conclusion he makes a plea for better creamery buildings.

Concerning the bacteria of blue milk, W. ZANGEMEISTER (*Centbl. Bakt. und Par. Med., 18 (1895), No. 11, pp. 321–324*).

Note on a recent milk case involving a sample of abnormal milk, R. BODMER (*Analyst, 20 (1895), No. 237, p. 266*).—The milk contained a high percentage of ash and low percentage of sugar.

Variation in fat content of milk, WEILANDT (*Milch Ztg.*, *24* (*1895*), *No. 50, pp. 813, 814*).—A discussion of the variation for one year in the fat content of milk furnished by a number of farmers, illustrated graphically.

The "Thistle" milking machine (*Australian Farm and Home, 5* (*1896*), *No. 1, pp. 17, 18*).—An account is given of the successful working of the machine (E. S. R., 7, p. 70) at a trial near Melbourne, South Australia.

Machine for making cheese in large quantities, P. SCHACH (*Ind. Lait.*, *21* (*1896*), *No. 2, pp. 9–11*).

Test of the centrifugal separator No. 3 of Joseph Meys, B. MARTINY (*Mitt. deut. landw. Ges.*, *1896, No. 2, p. 6*).

Experiments with 3 Victoria hand separators of different sizes (*Deut. landw. Presse, 23* (*1895*), *No. 10, p. 77*).

Notes on butter making by the use of centrifugal separators, J. W. ROBERTSON (*Canada Exptl. Farms Rpt. 1894, pp. 90–92*).—Popular remarks "prepared to meet the needs of butter makers who desire the assistance of specific simple directions."

Note on two samples of "filled" or lard cheese, R. BODMER (*Analyst, 20* (*1895*), *No. 237, p. 268*).—Two samples of cheese were analyzed by the author which he estimated to contain 40 and 30 per cent, respectively, of fat other than butter fat.

AGRICULTURAL ENGINEERING.

Silos and silage, F. H. KING (*Wisconsin Sta. Rpt. 1893, pp. 201–227*).—This is chiefly a summary of the work reported in previous publications of the station. The topics treated are the comparative cost of storing silage and hay, the losses in storing corn silage and corn fodder, the durability of silos, the depth and lateral pressure of silos, the weight per cubic foot of silage at different depths, the proper size of silos, covering silage, freezing of silage, details for constructing the round silo, and notes on clover as a silage crop. For the table giving the weight of silage per cubic foot at different depths, and published in the Annual Report of the station for 1891 (E. S. R., 4, p. 148), this report substitutes a new table with revised data.

"In view of the relatively small losses which appear to accrue from the freezing . . it is fair to conclude that present modes of silo construction offer adequate protection against injury from frost. . . . The only modification which is indicated . . . is such as will make it possible to reduce the ventilation of the silo lining and of the silo itself to as small an amount as possible during freezing weather."

In a silo, where soon after filling and again 10 days later, water at the rate of nearly 10 lbs. per square foot was applied, the rotten silage at the surface amounted to 2.5 in. and the moldy silage to a similar depth.

State laws relating to the management of roads enacted in 1894–'95, R. STONE (*U. S. Dept. Agr., Office of Road Inquiry Bul. 18, pp. 86*).—This is "a compilation of the most recent laws relating to highways passed by the various States of the Union, together with a condensed abstract of the same." The States whose laws are included in this bulletin are California, Colorado, Connecticut, Indiana, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New York, North Dakota, and Pennsylvania.

Tree roots in drain tile (*Amer. Gard., 17* (*1896*), *No. 58, p. 69, fig. 1*).—Brief remarks, with an illustration showing the way in which the roots penetrate the tile.

Rapid-growing, soft-wooded trees, such as willow, poplars, ailanthus, alders, and catalpas, are stated to be most troublesome.

Impounding storm waters, A. C. ROMIG (*Irrigation Age, 9 (1896), No. 2, p. 79*).

Water supplies for irrigation, F. C. FINKLE (*Irrigation Age, 9 (1896), No. 2, pp. 71–74*).

Irrigation and fertilizers, E. M. SKEATS (*Irrigation Age, 9 (1896), No. 2, p. 84*).

Irrigating with furrows, T. S. VAN DYKE (*Irrigation Age, 9 (1896), No. 2, pp. 74–77*).

Trenching irrigated land, F. C. BARKER (*Irrigation Age, 9 (1896), No. 2, p. 83*).

Beet harvesting machine, A. FRANK and P. BEHRENS (*Neue Ztschr. Rübenz. Ind., 36 (1896), No. 5, pp. 54–56, pls. 3*).

STATISTICS.

Reports of director and treasurer of Connecticut Storrs Station for 1894 (*Connecticut Storrs Sta. Rpt. 1894, pp. 5, 6*).—A brief review of the work of the year and the treasurer's report for the fiscal year ending June 30, 1891.

Tenth Annual Report of Wisconsin Station (*Wisconsin Sta. Rpt. 1893, pp. 335*).—This report briefly summarizes by topics the work done by the station during the 10 years of its existence. It contains in addition a brief history of the station by the director; a director's report, briefly reviewing the work of the year; a treasurer's report for the fiscal year ending June 30, 1893; a list of exchanges and acknowledgments; and a general index of the agricultural publications of the University of Wisconsin issued prior to 1894.

Report on agricultural laboratories and experiment stations to the International Congress of Agriculture at Brussels, L. GRANDEAU (*Ann. Sci. Agron., ser. 2, 2 (1894–'95), No. 2, pp. 271–310*).

Report on the agricultural experiment station at Darmstadt for 1894, P. WAGNER (*Ztschr. landw. Ver. Hessen, 1895, No. 40, pp. 325–328*).

Work of the agronomic station of Pas-de-Calais, A. PAGNOUL (*Ann. Sci. Agron., 2 (1894–'95), No. 1, pp. 104–139*).

The agricultural experiment station of Posen (*Landw. Centbl. Posen, 23 (1895), No. 41, pp. 243, 244*).

NOTES.

Illinois Station.—W. J. Fraser has been appointed assistant agriculturist of the station. Another stock barn has been erected on the university farm and important additions of dairy cattle made, the Jersey, Shorthorn, and Holstein breeds now being well represented in the university herd. For the purpose of making special investigations with the peculiar soils of southern Illinois, substations have been established at Edgewood and Odin.

Maine College and Station.—C. D. Woods, vice-director of the Connecticut Storrs Station, has been accepted the position of professor of agriculture in Maine State College and director of the station to succeed Professor Jordan.

New York Cornell Station.—H. W. Smith, clerk of the station, has resigned to accept a business position with a New York city firm.

New York State Station.—W. H. Jordan has been elected director of the station and has accepted, to take effect July 1.

North Carolina Station.—H. K. Miller, formerly of the Florida Station, has been appointed assistant chemist, and began work at this station March 1.

Vermont Station.—C. H. Jones, formerly connected with the Massachusetts State Station, has been appointed assistant chemist.

Association of American Agricultural Colleges and Experiment Stations.—The executive committee, having carefully considered the place and time of holding the next annual convention of the Association, has unanimously voted to call it at Washington, D. C., November 10. The formal call for the convention will be duly issued. The Section on Entomology and the Section on Mechanic Arts are designated to furnish parts of the program for the general sessions.

Ontario Agricultural College and Experimental Farm.—On February 27 the chemical laboratory was completely burned, causing a loss of about $10,000. Many notes of analyses were destroyed.

EXPERIMENT STATION RECORD.

VOL. VII. No. 8.

The efficiency of individual experiment stations, as well as the general usefulness of agricultural researches, will often be best promoted by making some one line of work the center about which all the other work of the station shall be grouped. The coöperation of investigators in different branches of agricultural science may thus be secured. The station will naturally reach a preëminence in its chosen line, and become more or less an authority on this subject. The relations of the different parts of the inquiry to each other will be more clearly brought out. There will be a tendency on the part of each worker to consider how his own researches may be aided by suggestions growing out of the work of his colleagues. Most of the problems of agriculture are complex. Their solution is to be sought through the combined efforts of investigators in various sciences. Thoroughly trained specialists working together in accordance with a well-matured plan are most likely to achieve satisfactory and permanent results. As scientific effort in behalf of the arts and industries of life is developed, the principle of organization which has been found so effective in practical affairs will no doubt be found to apply equally well in this field. The agricultural experiment stations are already possessed of an organized life. It only remains to strengthen and develop this, give it a more perfect form, and direct its energies more fully in definite lines. Concentration and combination of effort will give vigor and effectiveness to these institutions for the uplifting of agriculture.

One of our experiment stations has made the study of commercial fertilizers the central feature of its work. A part of its business under a State law has been the analysis and control of such fertilizers. The fertilizer markets have been closely observed, the value for fertilizing purposes of various refuse materials and by products has been determined, and economy in the use of fertilizers has been a subject of special study. Home mixing of fertilizers has been popularized, and the advantages from this system have been illustrated in many trials at the station and on private farms. The effects of fertilizers on the growth of different plants have been tested by laboratory and field experiments. The composition of plants grown with the aid of different fertilizers has been determined. Careful studies of methods of

analysis, including attempts to devise special apparatus, have been made. Hardly a phase of the general question of fertilizers has failed to receive attention, and the development of the station from the first has been very largely along this line. The success which has attended this station is a striking illustration of the good results of such concentration of effort.

Irrigation brings with it a large number of important problems, and presents an attractive field for the combined efforts of different scientists. The engineer, physicist, meteorologist, chemist, botanist, vegetable pathologist, horticulturist, and agriculturist may all find plenty to do for a long time and can work all the more effectively if they work in unison. The waters, soils, and plants need to be studied in connection with inquiries regarding the methods and effects of different irrigation systems. The stations located in the regions where irrigation is the foundation of agriculture should esteem themselves fortunate in having their lines of work predetermined by nature. The vastness of the interests at stake should naturally stimulate them to the most earnest and thorough work. The newness of agriculture in many of these regions in itself should provoke greater activity in the effort to establish right lines of practice founded on correct principles. The great number of problems may require not only coöperation within individual stations, but also coöperation among stations in the irrigation region. It is hoped that this matter will receive the earnest consideration of the communities most deeply interested in the successful application of irrigation to agriculture, and that the representatives of the people associated in any way with the experiment-station enterprise will use their influence to bring about such conditions at the stations as will enable them to do their most effective work along this line.

In this connection some investigations on the physiological rôle of water in plants, made in France by E. Gain, an account of which was given in the Record (7, p. 366), are quite suggestive. Hitherto comparatively little has been done in the study of plants grown under irrigation. Too often plants are irrigated with no reference to their requirements. The problems relating to the best times for irrigation and the amount of water to apply so as to secure the proper correlation of plant growth and economy of water supply are of the highest importance. In studying these questions numerous experiments should be conducted with different plants under various conditions, as a few trials with a limited number of plants will not serve as a basis for broad generalizations. The purpose for which the plant is grown must also be taken into consideration, a different quantity of water seeming to be required for seed production and vegetative growth.

FARMERS' INSTITUTES.

A. C. TRUE and F. H. HALL.

Farmers' institutes in this country have been an outgrowth or extension of the "open" or "public" meetings held by State or local agricultural societies. While they have not displaced such meetings, they now exceed them in number and popularity, and have become important agents in the education of the farmer in a number of States.

The institute is the adult farmers' school. Here they may learn from scientists and investigators the principles which underlie the art of agriculture and from successful farmers the best methods of applying those principles. The scientist at the same time learns the needs of the farmer and the problems regarded as most necessary of solution, and finds out from the results of actual practice the truth or falsity of theories and deductions made from experiments on a limited scale. The views of both farmer and experimenter are broadened, and sympathetic relations are established by the close social contact which marks the institute in its most perfect form.

The institutes are carried on under varied auspices and are supported in very different ways in different sections, but the character of the meetings themselves is essentially the same. They may last for but half a day, as in Louisiana, where the farmers assemble once a month at the experiment stations, or may continue 3 or 4 days. The tendency, however, seems to be toward shortening the duration and increasing the number of the meetings, thus distributing them among a greater number of localities. They are usually held during the winter, when the stress of the farm work is somewhat lessened, but in some States very valuable meetings have been held at other seasons of the year, the character of the work being adapted to some need specially felt at the time.

The programmes are planned to promote the interchange of ideas, a full and free discussion being sought upon topics introduced in an address or paper by some specialist. Speakers upon scientific subjects and successful farmers who have attained more than local reputations are usually selected as institute workers by those who have charge of the system of institutes for the State, or they may be chosen by the local authorities from lists of such workers prepared by the central bureau. The local committee invites successful farmers of the neighboring districts to explain their methods, and provides music and literary or other

general exercises. All persons in attendance, the humblest as well as the most prominent, are urged to ask questions upon points suggested in the addresses, and to present related facts gained from personal experience. A "question box" is frequently made use of, answers being given by the conductor of the institute or by someone specially fitted to supply the information asked.

For the evening sessions the usual plan is to have a popular lecture upon some subject of general agricultural interest. This address is made somewhat more elaborate and complete than those of the day sessions and less opportunity is given for discussion.

The institutes have been so successful and so popular in States where they are carefully and systematically conducted that there is a growing demand for increase in their number and frequency in these States and for the extension of similar systems to States which now hold institutes at irregular and infrequent intervals.

In nearly all of the States and Territories institutes or meetings of similar character are now held with more or less frequency and regularity. We are not at present advised, however, that institutes are held in Florida, Kentucky, Nevada, Utah, Wyoming, Indian Territory, or Alaska.

Meetings similar to farmers' institutes were held in Massachusetts nearly 60 years ago.

"In 1839 there was begun a series of weekly meetings in the hall of the Massachusetts house of representatives for the purpose of discussing agricultural questions. These meetings were inaugurated by the members of the legislature organized as the Legislative Agricultural Society, but were open to and participated in by the public. Lectures were given by prominent agriculturists and scientists. In 1840, the first meeting of the series for that winter was held January 13, and addressed by Henry Colman, commissioner for the agricultural survey of Massachusetts; Hon. Daniel Webster, and Prof. Benjamin Silliman, of Yale College. Mr. Webster's address was a comparison of the agriculture of England with that of Massachusetts.

"The records of these meetings are very meager, but they were reported in the newspapers, and their influence was potent upon the agriculture of the State through the many farmers who served as members of the legislature. Marshall P. Wilder was a leading spirit, being connected with the legislature for several years during the continuance of the society. These legislative meetings were continued until the session of 1867, when the meetings of the State Board of Agriculture superseded them."

On March 20, 1851, there was held in Boston an associated agricultural convention, composed of delegates from the several county agricultural societies of the State and many prominent farmers. The 3 sessions were devoted to discussion of agricultural matters and methods, and a board of agriculture was formed which was made the official

Massachusetts State Board of Agriculture by legislative enactment the next year.

Beginning in 1859, the Hingham Agricultural Society, a local organization of the State, has held meetings for discussion of agricultural topics; from 1860 they have been held every 2 weeks except during the heated season.

According to a resolution of the Board of Agriculture a public meeting was held in Springfield during four days of December, 1862, addresses being delivered by Dr. George B. Loring on "Agricultural education" and "Sheep raising;" by Dr. Samuel Hartwell on "Soils and agricultural resources of Massachusetts;" by Prof. S. W. Johnson on "The application of manures;" by L. H. Tucker, editor of the Albany Cultivator, on "Top dressing with manures;" by S. L. Goodale, secretary of the Maine Board of Agriculture, and Charles L. Flint, secretary of the Massachusetts Board of Agriculture, on "Dairying;" by Prof. Louis Agassiz on "Work performed by glaciers in preparing the soil of temperate regions for cultivation" and "Cattle breeding," and by E. W. Stebbins and others on "Field crops." These public meetings of the Board for lectures and discussions have been held annually since 1862.

In 1871 the State Board of Agriculture requested the 29 agricultural societies of the State to organize annual meetings for lectures and discussions, to be denominated the "Farmers' Institutes of Massachusetts." Several societies began holding meetings immediately and have continued to hold them regularly since that time.

In 1878 the Board pledged the societies its assistance in holding institutes, and in 1879 it required the societies (28) to hold 3 institutes annually. Upon fulfilling this and other requirements of the Board each society received the annual State bounty of $600.

In Connecticut, during 1860, Prof. John A. Porter, of Sheffield Scientific School, organized a course of lectures for farmers. Three lectures were given daily for a month, each being followed by a discussion by those in attendance.

The Connecticut State Board of Agriculture was established in 1866 and during January of that year held its first farmers' convention for lectures and discussion. These meetings have continued annually since that date with increasing attendance and interest. The Board also holds single day institutes at invitation of local organizations.

In 1870 the newly organized State Board of Agriculture of New Hampshire began a series of public farmers' meetings, the first being held at Concord, November 29 and 30.

In 1871 Vermont followed the example of New Hampshire, 3 public meetings being held in that year and 6 during 1872. The first one was held at St. Johnsbury at the invitation of the Caledonia Agricultural Society.

In 1872 Kansas Agricultural College inaugurated a series of institutes, the first one being held at Manhattan under the auspices of the Bluemont Farmers' Club.

The faculty of the Michigan Agricultural College, feeling a lack of sympathy between the farmers of the State and the college, asked the State Board of Agriculture, the governing body of the college, to authorize a series of institutes. In January, 1875, the first of a series of 6 meetings was held at Armada.

The Pennsylvania State Board of Agriculture in 1878 received an appropriation more than sufficient to provide for the regular meetings of the Board, and devoted the surplus to meetings at which persons not members of the Board read essays and gave lectures. The first of these meetings was held at Doylestown, May 30, 1878. Similar meetings had previously been held in the State by agricultural societies and farmers' clubs, but this was the first meeting at State expense. Such institutes have been maintained regularly since that time.

In 1879 Colorado joined the movement with a meeting held at Fort Collins, November 26, in the management of which the local organization and the State Board of Agriculture coöperated.

Ohio followed in 1880, Mississippi in 1881, and Maine and Missouri in 1883.

In 1885 the Board of Regents of the University of Wisconsin organized a course of institutes and appointed a superintendent of institutes to plan and manage them. In 1887 the State passed a law confirming this arrangement and authorizing an annual appropriation of $12,000 for support of institutes.

New York held farmers' institutes in 1886; Minnesota in 1887; Alabama, Delaware, Indiana, Oregon, and Texas in 1889; North Carolina and Virginia in 1890; Georgia, Illinois, and New Jersey in 1891; Iowa and Washington in 1892; Montana in 1893; Arkansas, Idaho, and North Dakota in 1894; Maryland in the winter of 1894–'95; Arizona in 1895, and New Mexico in 1896.

Nebraska reports that "local institutes have been held for many years;" Rhode Island that the first institute was held "perhaps 30 years ago;" Tennessee that "farmers' conventions" have been held for 25 years; and South Dakota that "local institutes have been held for at least 8 years."

In 20 States farmers' institutes receive direct appropriations or are regularly authorized and organized by legislative enactment. Of these, 6 States: Illinois, Michigan, Minnesota, New York, Pennsylvania, and Wisconsin intrust details of management to superintendents (or secretaries) of institutes. General management is left to the State Board of Agriculture in Michigan, to the State Department of Agriculture in Pennsylvania, to the Regents of the University in Wisconsin, to the State Agricultural Society in New York.

Ten States of the 20 leave the entire management in the hands of State Boards (or Commissioners) of Agriculture: Alabama, Connecticut, Maine, Missouri, New Hampshire, New Jersey, North Carolina, Ohio, Rhode Island, and Vermont.

Three States—Delaware, Iowa, and Massachusetts—make appropriations to counties or to local organizations and allow them to conduct the institutes as seems desirable.

Indiana appropriates funds for institutes through Purdue University.

In several other States the funds appropriated for institutes are apportioned to the counties by the general authorities charged with supervising these meetings.

The amounts appropriated for institutes vary greatly, from $500 per annum (which the State treasurer refuses to pay) in North Carolina to $15,000 in New York.

Delaware gives $200 to each of her 3 counties; Iowa $40, and Illinois $50 to each county holding one or more institutes; and Massachusetts gives $600 to each of 35 societies in the State, one requirement being the holding of at least 3 institutes, and $1,850 to the State Board of Agriculture for institute work.

Alabama and Maine each appropriate $3,000; Connecticut gives the State Board of Agriculture $3,500, part of which is for institute work; Missouri, $4,000; Indiana, Michigan, and Vermont, $5,000; New Jersey, $6,000 for all expenses of the Board of Agriculture; Pennsylvania, $9,500; Ohio, a *per capita* tax in counties holding institutes, expending $10,425 in 1894; Wisconsin, $12,000; Minnesota, $13,500. The State Agricultural Society of New York expended more than $18,000 on institute work in 1894.

South Dakota provides by law for the holding of institutes by the Board of Trustees of the State Agricultural College, but has thus far made no appropriation for their maintenance.

In the remaining States the institutes have no legal recognition, but are organized under general statutes relating to the promotion of agriculture, or are under local control.

In Virginia the Commissioner of Agriculture has held institutes in coöperation with the local members of the State Board of Agriculture, the Board giving at first $200 and now $300 to each Congressional district.

In the following 14 States institutes have been conducted by the colleges of agriculture, in most cases in coöperation with local organizations: Arizona, Arkansas, California, Georgia, Kansas, Maryland, Mississippi, Montana, New Mexico, Oregon, South Carolina, South Dakota, Washington, and West Virginia.

Institutes are regularly held at the experiment stations in Louisiana, and others are conducted under control of different associations in the State.

Institutes under local management have been held in 7 States, in most cases with the aid of State boards or colleges. These are Colorado, Idaho, Nebraska, North Dakota, Oklahoma, Tennessee, and Texas.

The number of institutes held during a season varies greatly in different States. New York now holds at least 250 institutes in a single year. Some of the other States holding numerous institutes are Alabama, Georgia, Kansas, New Jersey, Rhode Island, from 20 to 30 annually; Maine and Missouri, 40 to 50; Michigan, 65; Illinois, Indiana, and Iowa, 1 or more in nearly every county; Wisconsin, 100; Massachusetts, 125; Pennsylvania, 150, and Ohio, 180.

The attendance is also an exceedingly variant quantity. Some States report the average number of persons present at each institute as low as 20 to 30, but this has usually been where the movement is in its infancy; the number of meetings in a State and the attendance at each meeting usually increase at the same time. New Hampshire reports an average attendance of 100; Maine, 130; Indiana, 230; Ohio, 420, and Wisconsin, 490. Michigan has held meetings attended by 1,500 persons, Louisiana 2,000, and New York and Pennsylvania as high as 7,000.

Twenty of the States publish in more or less complete form the proceedings and papers read at the institutes, but in the other States the reports of the local and agricultural press are the only records. In New York the annual reports of the State Agricultural Society contain in full the proceedings and papers presented at the institutes; in thirteen States the reports of the State Boards of Agriculture have devoted more or less space to reports of these meetings; Minnesota, Ohio, Pennsylvania, Tennessee, and Wisconsin issue special publications containing institute papers. The Minnesota "Institute Annual" is issued in an edition of from 25,000 to 30,000, and the Wisconsin "Farmers' Institute Bulletin" in an edition of 50,000 annually.

During the present year a series of meetings has been inaugurated in New York which differ in some respects from the ordinary farmers' institutes. These meetings have been conducted under the auspices of a voluntary association having its headquarters in New York City. The general purpose is to bring some of the characteristic features of the University Extension movement to bear more directly on the education of the masses of our rural population. The meetings have been in charge of a general manager, who has made the preliminary arrangements for them and has presided at them. The plan is to hold at some convenient point in a township a meeting continuing through two or three days, at which addresses are made by specialists in various branches of science and practice related to agriculture. Opportunity is afforded for discussion as far as practicable. Some exercises are given which will be interesting and instructive to children, and the attendance of the public schools in a body is secured at one session. It is thus hoped to awaken the interest of the entire community in

matters relating to agricultural education. When attention has been called to this subject through the central meeting, smaller gatherings are held at the outlying schoolhouses or other convenient places in the same township. Meetings resembling more or less closely those of the University Extension movement have also been held in Connecticut, Georgia, Kansas, and New Jersey.[1]

Another movement inaugurated by the State College of Pennsylvania is clearly allied to the farmers' institutes. The college publishes annually the outlines of a course of home readings for farmers, the books to be included in the course being named by title. At the request of any farmers' club in the State which will undertake to pursue this course of readings the college sends a representative to explain the course and to aid the club in any other practicable way to carry out the proposed plan. Michigan also has established a course of home readings for farmers.

As the farmers' institutes develop, and other movements for promoting the general education of the farmers in lines directly relating to their art are undertaken, the need of skilled agents for such work is increasingly felt. The agricultural experiment stations, through their numerous publications distributed directly or as reprinted in the agricultural press, have awakened a widespread desire among farmers for more definite and thorough information on matters relating to their business. While well prepared papers and discussions by successful practical farmers are justly welcomed at institutes, there is, nevertheless, a growing demand that persons who take a leading part in these meetings shall be able to go beyond the details of successful practice and explain the principles on which the practice is based. Instruction in the elements of agricultural science which will enable the farmers to intelligently use the publications of the stations is also demanded. The efficient institute worker must, therefore, not only be a well educated man, but must also possess the rare talent which will enable him to translate scientific facts and principles into the language of the people. He must have a keen sense of what can profitably be attempted within the limits of one or two addresses before a strange audience and great readiness in adapting himself to unfamiliar surroundings and constantly shifting exigencies. The successful investigator or teacher may utterly fail as an institute worker. Thus far, however, the officers of our agricultural colleges and experiment stations have been largely called upon to do institute work, and their faithful and laborious services in this line have been greatly appreciated. As the more legitimate duties of their offices increase in complexity and amount it will be necessary for them to withdraw very largely from outside engagements. At the same time the rapid increase in the number of institutes makes it still less practicable for these officers to meet the demands made upon them for such work.

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 24, p. 49.

It remains, therefore, for the general managers of farmers' institutes to organize a corps of trained workers. This is the next step to be taken in the development of farmers' institutes in this country. Indeed, the movement has already begun and a nucleus for such a force has been formed.

The farmers' institutes have clearly proved their usefulness. When more thoroughly organized throughout the country, as they have been in a few States, they will take their place among the important regular agencies for the education of the farmer.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The distribution of boric acid in nature, H. JAY (*Compt. Rend., 121 (1895), No. 21, pp. 896–899; abs. in Rev. Sci., ser. 4, 5 (1896), No. 1, p. 22*).—The author concludes from his investigations that boric acid is generally distributed throughout the earth's crust, that both cultivated and wild plants take up boric acid from the soil and from water, and that when this substance is introduced in small quantities into the stomach of animals it is not assimilated, but is thrown out in the urine and other excretions.

[J. S. Callison, in an article entitled "The distribution of boracic acid among plants,"[1] published in 1890, reported the results of examinations of the ash of 30 fruits, 45 grains and vegetables, 16 miscellaneous plants, and of 7 fertilizers and 19 chemicals, in all of which he found boric acid present. He detected small amounts of boric acid in plants grown upon soils which did not contain enough boric acid to respond to the most delicate chemical test. The author in this article calls attention to previous work in this line by Baumert,[2] Rising,[3] and Crampton.[4] These investigators first observed the almost constant presence of boric acid in the grape. Crampton suggested that its distribution was more extended, and in fact reported its detection in the ash of other plants besides grapes.—ED.]

The inulin of garlic, hyacinth, narcissus, and tuberose, R. CHEVASTELON (*Jour. Pharm. et Chim., ser. 6, 1895, No. 2, p. 83; abs. in Jour. Chem. Soc., 70 (1896), Jan., pt. 1, p. 5*).—The reserve material of the bulbs and other underground parts of certain monocotyledons is a kind of inulin. The inulin of garlic, $C_6H_{10}O_5$, is a white inodorous amorphous powder. It is very deliquescent and has an insipid taste. It melts at 175 to 176°, is soluble in water and dilute alcohol, but only sparingly in strong alcohol. Rotatory power, $[a]_D = -39°$. It does not reduce an alkaline copper solution, and is completely hydrolyzed by acids with the formation of levulose. It is precipitated by neither normal nor basic lead acetate, except in the presence of ammonia. It is not hydro-

[1] Jour. Analyt. Chem., 4 (1890), pp. 191–197.
[2] Landw. Vers. Stat., 33 (1885), p. 39.
[3] Rpt. Sixth Viticultural Convention, 1888.
[4] Amer. Chem. Jour., 2 (1880), p. 227.

lyzed by amylose, but is resolved into levulose by an enzym, inulose, which is secreted by *Aspergillus niger*, and is similar to the enzym of the inulin of the Jerusalem artichoke and atractylis. The inulin of garlic is not fermented either by hydrolytic or non-hydrolytic yeasts.

The sap from the offshoots of garlic bulbs contains only traces of reducing sugars, and yields nothing but levulose on hydrolysis.

The inulin of the hyacinth, narcissus, and tuberose is identical with that of garlic. The hyacinth bulb contains a small amount of levulose and much starch. The bulbs of narcissus and tuberose contain no starch. In the former dextrose and levulose were found; in the latter only dextrose.—W. H. KRUG.

Note on the chemical composition of some mucilages, K. YOSHIMURA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 4, pp. 207, 208; Amer. Jour. Pharm., 68 (1896), No. 2, p. 111; abs. in Jour. Chem. Soc., 70 (1896), Jan., pt. 2, p. 60*).—The author examined the following plants and determined the chemical composition of the mucilages contained in them: *Sterculia platanifolia* (young shoots), *Colocasia antiquorum* (tuberous roots), Opuntia (fleshy stem), *Vitis pentaphylla* (stems and leaves), *Œnothera jaquinii* (stems and leaves), and *Kadzura japonica* (young leaves and stems).

In the determinations the slimy extracts of the various plants were concentrated, precipitated with alcohol, and the washed precipitates boiled with 2 to 4 per cent sulphuric acid. The acid was removed by barium chlorid and the filtered solutions concentrated and examined.

"[It was found that] the mucilage of *Sterculia platanifolia* consists of a mixture of araban with some galactan, and that of *Colocasia antiquorum*, since it gave neither mucic acid nor the pentose or mannose reaction, but an osazone which was proved to be identical with phenylglucosazone, consists probably only of a polyanhydrid of d-glucose.

"The mucilage of *Vitis pentaphylla*, as well as that of Opuntia, consists principally of galactan, while those of *Œnothera jaquinii* and of *Kadzura japonica* contain galactan and araban."

The inversion of starch by pancreatic ferments, K. CHODOMSKÝ and O. SULĆ (*Věstnik král. české společnorti náuk, II, Cl. XXX; abs. in Chem. Ztg., 20 (1896), No. 4, Repert., p. 7*).—When 200 gm. of starch in the form of 20 per cent paste was treated with pancreas extract for 18 days at 38°, filtered and evaporated, it gave 160 gm. of a sirup in which glucose and achroödextrin were found. The presence of maltose or isomaltose was not definitely proved, although in the preparation of the osazones small fractions soluble in boiling water and having a melting point of 184 to 193° were obtained. In another series of experiments different results were obtained. Fifty cubic centimeters of 1 per cent starch paste was treated in a flask at 36° with a glycerol extract of the pancreas and 10 cc. of a 10 per cent alcoholic thymol solution. In 24 hours 25 cc. of the filtrate reduced 39.7 mg. of copper, in 3 days 50.3 mg., in 7 days 66 mg., and in 9½ days 66.6 mg. After one day $[a]_D$ was +1.164°, in 3 days +1.391°, in 7 days +1.29°, in 9½ days

+1.353°. The iodin reaction was blue on the first day, but subsequently reddish-violet. Crystalline osazones were not obtained, which makes the presence of maltose or isomaltose more probable. The extract of a fresh pancreas contained no ferments.—W. H. KRUG.

The action of alkalies on sugars, LOBRY DE BRUYN and A. VON EBENSTEIN (*Rec. trav. Chim. Pays-Bas, 1895, p. 203; abs. in Chem. Ztg., 19 (1895) No. 102, Repert., p. 404*).—The action of alkalies on dextrose results in the formation of mannose and levulose. Levulose can in a similar manner be converted into dextrose and mannose, and mannose into dextrose and levulose. The alkaline carbonates and magnesium hydrate act like the alkalies. The rapidity of the decrease in rotatory power depends on the concentration and temperature.—W. H. KRUG.

The multirotation of dextrose, A. LEVY (*Ztschr. physikal. Chem., 17 (1895), p. 301; abs. in Jour. Chem. Soc., 68 (1895), p. 586*).—The retrogression of the multirotation of a solution of dextrose is accelerated by the addition of a small quantity of an acid or base. The velocity of the reaction was found to be dependent on the nature and concentration of the acid or base, and is intimately connected with its affinity constant.—W. H. KRUG.

Ammonia derivatives of the carbohydrates, C. A. LOBRY DE BRUYN (*Ber. deut. chem. Ges., 28 (1895), p. 3082*).—Crystalline derivatives have been prepared with dextrose, lactose, maltose, galactose, xylose, arabinose, rhamnose, fructose, and mannose by dissolving the sugars in methyl alcohol saturated with ammonia. They are all formed with the elimination of one molecule of water, and have been provisionally called osamins. They are all dextrorotatory and unstable.—W. H. KRUG.

Organic solids not sugars in cane juice: I. Nitrogenous substances, W. MAXWELL (*Louisiana Stas. Bul. 38, 2d ser., pp. 1371–1386*).—One object of these investigations was to obtain a scientific explanation why clarification of diffusion juice is more difficult than that of mill juice. Sugar planters observe that the impurities in diffusion juice coagulate less completely than those in mill juice, in which latter an easily removable blanket is formed. To explain this difference in behavior of the two juices, determinations were made of the albuminoid nitrogen and of the amid nitrogen in both, with the following results:

Albuminoid and non-albuminoid nitrogen in mill and diffusion juice.

	Striped cane		Purple cane	
	Albuminoid nitrogen	Non albuminoid nitrogen	Albuminoid nitrogen.	Non albuminoid nitrogen
	Per cent	*Per cent*	*Per cent*	*Per cent*
Mill juice	35 0	65 0	34 3	65 7
Diffusion juice (cold diffusion)	24 3	75 7	25 0	75 0

When the diffusion battery was kept at 150° F. much more nitrogen was extracted from the cane and contained in the juice than with cold

diffusion. The following table shows that the juice obtained by cold diffusion contained more albuminoid nitrogen and less amid nitrogen than juice from diffusion at 150° F.:

Albuminoid and non-albuminoid nitrogen in total nitrogen of juice.

	Albuminoid nitrogen.	Non-albuminoid nitrogen.
Diffusion with cold water	25.0	75.0
Diffusion at 150° F	10.9	89.1

"The action of the diffusion (at a temperature high enough to coagulate the albuminoids) upon the nitrogenous impurities present in cane juice, suggests an explanation of the cause why diffusion juices do not clarify as readily as mill juice does. The albuminoids are the bodies which coagulate and form the 'blanket' when the juice is heated in the clarifiers. When the albuminoids coagulate and rise to the surface most probably they lift many of the mucilaginous bodies (gums) with them. Diffusion coagulates and leaves the albuminoids largely behind in the chips, however, and their good effect in the clarifiers is lost. Moreover, diffusion extracts an excess of those nitrogen bodies which are not albuminoids and which do not coagulate and become removed by our clarification methods."

The chemical nature of the non-albuminoid nitrogenous bodies in cane juice was investigated; no ammonia and only a trace of alkaloid was found. In young cane suckers asparagin was found.

"Care is required in using lime in clarification; and it is clearly suggested that as soon as the 'blanket' is formed it should be removed, and not broken up by turning on the steam in the clarifiers to a boil. If that is done the 'blanket' is broken to pieces and the great heat with the lime will decompose some of the albuminoids."

Of the total nitrogen in mill juice the proportion of albuminoid nitrogen increased as the cane became more mature, or as it was worked later in the season.

In studying the composition of the clarified juice it was found that—

"The total nitrogen in the diffusion juices was reduced by one-third in the clarifiers. The clarifiers did not remove all the albuminoids, about one-fifth of the total amount being still left in the juice. . . .

The decrease in the total nitrogen found in the clarified in comparison with the diffusion juice is owing to the removal of the largest part of the albuminoids; to the conversion of a small part of albuminoids into amids, whereby some free ammonia is given off; and to the conversion of asparagin and possibly glutamin into aspartic and glutamic acids, in which reactions free ammonia is also given off."

Organic solids not sugars in cane juice: II. Non-nitrogenous matters, W. MAXWELL (*Louisiana Stas. Bul. 38, 2d ser., pp. 1386–1395*).—"The results of these investigations lead to the conclusion that the so-called gums present in cane juice are a mixture of vegetable mucilages and vegetable gums, which are severally soluble in water, dilute acid, and cuprammon. The mucilages are composed largely of the hexosan bodies, and when boiled with dilute acid break up into glucose sugars and cellulose. . . . The true gums, which form only a small part of

the so-called crude gums, consist chiefly of pentosans, which, when boiled with dilute acid, yield pentose sugars."

Of the gums soluble in water, 26 per cent consisted of mineral matter. By the use of mercuric nitrate to remove the amids and gums from cane juice the author obtained results indicating that it is these substances rather than the glucoses which chiefly prevent crystallization.

"Of the practical value of mercuric nitrate there is nothing to say at present. It is a poison, and not easily wholly removed; by means of the electric current, however, we have removed every trace of mercury from the juice clarified by that reagent."

A study of the effect of electric current upon the gums afforded results not entirely conclusive.

"Not only does it aid in getting rid of the albuminoids, it coagulates and throws out a portion of the gums, and the amount of gums removed depends upon the excess of lime used. . . . If the juice is boiled with free lime present, the glucose is destroyed and the juice reddened. That can be completely avoided if the juice is brought to neutrality with acid after the lime has done its work, and before heat has been applied to boiling."

The effect of freezing upon the gums was studied, and it was found that freezing caused a change of the gums and albuminoids into other compounds and a reduction in the sucrose content of juice from 10 to 6 per cent and in the solid matter from 13.6 to 10.4 per cent.

The non-sugars in sugar-cane juice, W. MAXWELL (*Bul. Assoc. Chim., 13 (1895), p. 371; abs. in Chem. Ztg., 19 (1895), No. 92, Repert., p. 350*).—Alcohol precipitates considerable "gum" from the concentrated juice. This "gum" consists of several bodies, some of which are readily—others only slowly—attacked by dilute acids. Hydrolysis yields various sugars (hexoses and pentoses). The gum is probably hemicellulose.—W. H. KRUG.

Dextran, one of the gums of our sugarhouse, G. C. TAYLOR (*Louisiana Stas. Bul. 38, 2d. ser., pp. 1334-1340*).—This is an account of the bacteriological work done on a gum frequently found in sugarhouses and believed from chemical investigation to be dextran. The gum was found to be produced from sugar by a microörganism which was isolated and studied.

"Ten per cent pure sugar solutions inoculated with this organism were half destroyed in 2 weeks and totally destroyed in 4. Having found these organisms such powerful destroyers of sugar, experiments were instituted to determine the extent of their presence in our sugarhouses. Every carload of wagon sugar in the hot room was teeming with them. Even those cars that contained the massecuite made from sirup treated with alcohol, coming from sugar cane and sorghum, contained them by the millions. Both the washed and the unwashed brown sugars from the centrifugal contained them. It is estimated that from 10 to 40 per cent of the wagon sugar of the State is destroyed by this organism."

After the sugar has been changed to gum, this gum is believed to be acted upon by another microörganism which destroys it, converting it into a reddish brown liquid. "The same bacterium, it is believed,

accompanies the cane borer through the stalk and reddens his pathway. It is probably the same one also that reddens the tops of our stubbles in fall and winter." The nature of the changes induced by this bacterium has not been studied chemically.

A new method for the qualitative distinction of sugars, A. VILLIERS and FAYOLLE (*Compt. Rend., 121 (1895), p. 75; Neue Ztschr. Rübenz. Ind., 35, No. 26, p. 285*).—The method is founded on the fact that a solution of rosanilin which has been decolorized by sulphurous acid is restored to its original color by aldehydes, but remains colorless with ketones. Some sugars, as dextrose, invert sugar, and galactose, as well as the reducing dextrins, act like aldehydes, while levulose and sorbin act like ketones. The sugar solution must be neutral, concentrated, and absolutely pure.—W. H. KRUG.

The determination of crude fiber in sugar cane, J. L. BEESON (*Louisiana Stas. Bul. 38, 2d. ser., pp. 1349–1356*).—The author calls attention to the difficulty of obtaining concordant results in the determination of crude fiber in the cane "on that portion of the stalk which is insoluble in water." He gives the results of work on the extraction of the chips, the losses in the preparation of the sample, the loss due to the evaporation from the chips, and the distribution of the fiber in the cane.

"To summarize briefly, it has been found in the course of this work that by adding 9 volumes of water to the cane chips and letting stand until diffusion was complete, 5 of such extractions removed practically all soluble bodies. Water at 75 to 80° C. may be added to the chips in the beginning without fear of coagulating the soluble albuminoids, thereby hastening the diffusion. It is probable that there is a mechanical loss in cutting the cane into chips, due to the rupture of the cells. The loss by evaporation from the chips may be quite considerable when exposed for some time on a warm day. The percentage of fiber in the nodes is approximately twice as great as in the contiguous internodes, the butt node containing the most fiber. The variation in fiber content is greatest between the rind and pulp. After the rind is removed, the fiber content grows less as the center is approached, the latter showing quite a low percentage

"In the light of this work, it would appear more profitable to try to devise some easy, accurate method of estimating the sucrose upon the weight of the cane directly than to attempt to devise an accurate method of fiber estimation, there being difficulties in the latter which in the nature of the case are almost insurmountable."

The estimation of gelatin in meat extracts and commercial peptones, A. STUTZER (*Ztschr. analyt. Chem., 1895, No. 5, pp. 568–570*).—The author determines gelatin, which he considers a very difficult process in the analysis of extracts and peptones, by drying to constant weight with fine sand in a water bath from 5 to 7 gm. of dry or 20 to 25 gm. of liquid preparation, extracting 4 times with 100 cc. absolute alcohol, treating the residue with a mixture of alcohol and ice water (100 gm. alcohol, about 300 gm. ice, and water to make 1,000 gm.), using about 100 cc. each time, stirring 2 minutes, and decanting the supernatant liquid into a beaker. This process is repeated until the supernatant liquid is colorless, which usually requires 4 extractions. The temperature should not rise above 5° C.

The extracts are filtered through asbestus filters, and the residues are washed with the alcoholic ice water. All the filters and residues and the sand are now repeatedly boiled with water in a porcelain dish, the water evaporated, and the gelatin nitrogen determined in the residue.—B. W. KILGORE.

The viscosimetric examination of butter for foreign fats, N. WENDER (*Jour. Amer. Chem. Soc., 17* (*1895*), *No. 9, pp. 719–723*).—A description of the author's "fluidometer," which consists of a U-formed capillary tube, both of the limbs of which are enlarged and divided in such a manner that one arm holds 10 cc. and the other 2 cc. of liquid. The liquid flows from the larger arm into the smaller through the capillary tube, according to the law of communicating tubes. The viscosity is calculated from the time required for the liquid to flow from the first division to the last upper division.

Butter, butter substitutes, or like fats are dissolved in chloroform in order to avoid maintaining the melting temperature of the fat during the operation. The viscosity of butter was found to be always smaller than that of margarin, and the viscosity of different butters showed but relatively small differences, while margarin from different sources showed much larger differences.—H. J. PATTERSON.

The examination of lard for impurities, D. WESSON (*Jour. Amer. Chem. Soc., 17* (*1895*), *No. 9, pp. 723–735*).—A description is given of the author's modification in the use of the Bechi test, which consists in first purifying the sample of lard by washing it with a 2 per cent solution of nitric acid. This is done by shaking 50 gm. of the melted lard in a flask with 25 cc. of 2 per cent nitric acid. Allow to settle on a steam bath, remove the acid, and wash at once with 50 cc. of hot water. Lards which have been heated at high temperatures or for a long time should be washed with dilute caustic soda before treatment with nitric acid.

The silver nitrate solution is made by dissolving 2 gm. of silver nitrate in 200 cc. of alcohol and 40 cc. of ether, exposing it to some light until reaction ceases, and then filtering off the solution.

The author also gives a review of the phosphomolybdic-acid test, the sulphuric-acid test, and various physical tests.—H. J. PATTERSON.

The determination of the solid fat in artificial mixtures of vegetable and animal fats and oil, J. H. WAINRIGHT (*Jour. Amer. Chem. Soc., 18* (*1896*), *No. 3, pp. 259–261*).—The method is claimed to be but a rough assay, yielding results within 1½ per cent of the correct amount. It consists in heating 150 gm. of the sample in a beaker in a boiling water bath for at least 1 hour, allowing to cool gradually to 75 to 80° F. without removing the beaker from the bath, and then keeping for at least 12 hours in a moderately warm place. The contents of the beaker are thoroughly mixed, 50 gm. wrapped in a double thickness of canton flannel, and pressed. After all the oil has drained off, the cake of solid fat, consisting essentially of stearin, is removed from the cloth and weighed.—H. J. PATTERSON.

The use of the calorimeter in detecting adulterations of butter and lard, E. A. DE SCHWEINITZ and J. A. EMERY (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, pp. 174–179*).—A number of butters and butter compounds of known origin were examined and gave decided and distinctive results. "The figures obtained for butter fat are a little higher than those Stohman gives for pure butter. The steady increase in the calories of the mixtures is in proportion to the amount of oleomargarin added to the butter, and this taken in conjunction with the iodin number gives additional confirmatory evidence of the character of the sample." With lard the results were not as distinctive.—H. J. PATTERSON.

Determination of acetic acid in vinegar, A. R. LEEDS (*Jour. Amer. Chem. Soc., 17 (1895), No. 9, p. 741–744*).—A review is given of the methods of Pettenkofer, Mohr and Blyth. The method used consisted in diluting 50 cc. of vinegar with 50 cc. of water and titrating with baryta, using turmeric, as recommended by Pettenkofer, to indicate the end of reaction.—H. J. PATTERSON.

Gravimetric method of estimating phosphoric acid as ammonia phosphomolybdate, T. S. GLADDING (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, pp. 23–27*).—To 25 to 50 cc. of the phosphoric acid solution add 25 cc. of ammonia (specific gravity 0.900), and acidify with nitric acid (specific gravity 1.42.) Place on a water bath maintained at 50° C., add molybdate solution (10 per cent) at the rate of 3 drops per second until there is an excess of 10 cc., and allow to remain on the bath for 10 minutes. Filter, wash first with dilute nitric acid (1 : 100) and then with distilled water. Dry at 105° C. in a water oven containing dilute glycerole (specific gravity 1.160) until the weight is constant. The following is given as the correct formula for the yellow salt:

$$24\,MoO_3,\ P_2O_5,\ 3(NH_4)_2O + 21\,MoO_3,\ P_2O_5,\ 2(NH_4)_2O.H_2O + 5\,Aq.$$

—H. J. PATTERSON.

Note on the rapid estimation of insoluble phosphate, V. EDWARDS (*Chem. News, 73 (1896), No. 1886, p. 25*).—The author has made the following application of the uranium method to the quick estimation of insoluble phosphoric acid in superphosphates, guanos, etc.:

About 0.5 gm. of substance is thoroughly washed on a filter with cold and hot water to remove the soluble phosphoric acid, the residue washed into a beaker, dissolved in a small quantity of hydrochloric acid, and filtered through the same filter used for washing. The insoluble residue is well washed with water, the filtrate diluted to 300 cc., made slightly alkaline with ammonia, and then made just acid with acetic acid. The filtrate is warmed on a sand bath and titrated with uranium acetate. The great dilution of the solution is said to increase the accuracy of the method.—B. W. KILGORE.

Estimation of insoluble phosphate, G. H. ALLIBON (*Chem. News, 73 (1896), p. 47*).—The author in a note to the editor remarks that he considers that the method described by V. Edwards for the "Rapid esti-

mation of insoluble phosphoric acid volumetrically" (see above) would give quite inaccurate results on account of the precipitation of iron and aluminum phosphates when the hydrochloric acid solution is neutralized with ammonia, and which would not be again dissolved by acetic acid or acted on by the uranium acetate solution.

The author describes briefly the following method, used by himself when quick results are desired: Wash 1 to 2 gm. of substance with cold and hot water by decantation and then on a filter with hot water, dissolve the residue in hydrochloric acid, filter, wash with hot water, heat the filtrate to boiling, and add an excess of ammonia. Filter, wash precipitate twice with hot water, and dissolve it in dilute hydrochloric acid (1:4). Heat the solution to boiling, add an excess of ammonia, filter, dry, burn, and weigh the insoluble phosphate.—B. W. KILGORE.

Estimation of insoluble phosphate, V. EDWARDS (*Chem. News, 73 (1896), p. 71*).—The author, replying to the criticism of his former article by Allibon (see above), admits that in the method described by him iron and aluminum are disturbing factors of unknown value, but he considers that the judgment of the analyst would enable him to know when to trust the results and when to distrust them for factory work.—B. W. KILGORE.

Estimation of insoluble phosphate, G. H. ALLIBON (*Chem. News, 73 (1896), p. 94*).—This is a note in further reply to V. Edwards as regards his modification of the uranium method (see above), the point brought out being that the iron and aluminum present in fertilizers are generally too large in amount to allow of the use of the method.—B. W. KILGORE.

On some properties of ferric phosphate, R. M. CAVEN (*Jour. Soc. Chem. Ind., 15 (1896), No. 1, pp. 17-19*).—The author has studied the precipitated ferric phosphate. One of the most important facts brought out relating to chemical analysis is that ferric phosphate undergoes hydrolysis when washed with hot water, gradually losing phosphoric acid and becoming basic.—A. M. PETER.

Acidimetric estimation of vegetable alkaloids, a study of indicators, L. F. KEBLER (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 822-831*).—The primary object of the investigation was to make a study of the indicators best adapted to this class of work. Tests were made of Brazil wood, cochineal, hæmatoxylin, litmus, and methyl orange, used in connection with pure alkaloids and the crude alkaloids as they exist in nature. The results showed that hæmatoxylin, Brazil wood, and cochineal are best adapted to this class of work, their value being in the order named. Methyl orange was very unreliable.

A list of references to the literature on indicators during the past 20 years is appended.—H. J. PATTERSON.

A chemical study of the glycogen of fungi, G. CLAUTRIAU (*Havez, 1895; abs. in Nature, 1896, Feb. 6*).

On pentoses and pentosans and their determination by furfurol distillation, M. KRUGER and B. TOLLENS (*Ztschr. Ver. Rübenz. Ind., 1896, Jan., pp. 21-25*).

On solanin and its determination in the potato, N. S. KLEPZOW (*Jour. ochranenija narodnawo sdrawija, 1895, p. 659; abs. in Chem. Ztg., 19 (1895), No. 90, Repert., p. 338*).

Determination of the value of flour, A. GIRARD (*La Meunerie Française, 12 (1896), No. 125, pp. 8-10*).—The author gives a review of his method of examining flour. The gluten is separated from the starch and impurities by forming the flour into a cake and washing with running water. The starch and impurities are separated with a fine sieve and the impurities examined further with a microscope.

Determination of caffein in tea, E. H. GANE (*Jour. Soc. Chem. Ind., 15 (1896), No. 2, p. 95*).—The author made a considerable number of parallel determinations by Paul's and by Allen's methods. The conclusion was reached that the latter method gave the more valuable results, all the caffein not being extracted by the former.

A rapid method for determining arsenic, R. ENGEL and J. BERNARD (*Compt. Rend., 122 (1896), No. 7, pp. 390-392*).—The arsenic is precipitated in HCl solution by hypophosphorous acid, and titrated with standard iodin solution in the presence of sodium bicarbonate.

On the determination of arsenic, A. GAUTIER (*Compt. Rend., 122 (1896), No. 8, pp. 426, 427*).—The author defends his method published in 1875 against the criticisms of Engel and Bernard.

On the determination of carbon dioxid by absorption, H. H. HEIDENHAIN (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, pp. 1-7, fig. 1*).—A study to discover the causes of error in the use of the apparatus described by Fresenius.

On the determination of nitrogen in Peruvian guano, HEIBER (*Landw. Vers. Stat., 46 (1895), p. 407; abs. in Chem. Ztg., 20 (1896), No. 12, Repert., p. 23*).

Note on the volumetric determination of phosphoric acid, M. DE MOLINARI (*Bul. Assoc. Belge Chim., 9 (1895), No. 7, p. 213; Ztschr. Ver. Rubenz. Ind., 1896, Jan., pp. 25-28*).—Reports comparisons of Pemberton's method with the citrate method on mineral phosphates and Thomas slag with very satisfactory results as regards the first method. The only modification adopted in case of slags was to wash the molybdic precipitate twice with 1 per cent nitric acid before washing with water. The method was found unreliable when free sulphuric acid and sulphate were present.

The determination of the readily soluble phosphoric acid in Thomas slag, M. GERLACH and M. PASSON (*Chem. Ztg., 20 (1896), No. 11, pp. 87, 88*).—Instead of Wagner's solution, which contains 60 gm. of citric acid per liter, 46 of which was neutralized with ammonia, a solution containing 14 gm. of free acid and 4.6 gm. of combined acid was used with good results. With this solution the results agreed with those from the use of Wagner's solution and required less rotation, one-half hour being sufficient.

The analysis of slag by the Wagner method, L. GRANDEAU (*Jour. Agr. Prat., 60 (1896), No. 8, pp. 274, 275*).—A letter to M. Crispo protesting against the adoption of Wagner's method exclusively for slags omitting the determination of total phosphoric acid.

Analysis by volumetric methods of chlorids, hypochlorites, chlorates, and perchlorates, A. CARNOT (*Compt. Rend., 122 (1896), No. 8, pp. 449-454*).

Separation of solid and liquid fatty acids, L. DE KONINGH (*Jour. Amer. Chem. Soc., 17 (1895), No. 9, pp. 740, 741*).

On the microscopic detection of beef fat in lard, T. S. GLADDING (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, p. 189*).

Note on the bromin heat value of oils and fats, J. A. WILSON (*Chem. News, 73 (1896), No. 1890, p. 87*).—The author determined the heat of bromination of a number of oils and fats by the method of Hehner and Mitchell (*Analyst, 1895, p. 146*), and finds the results to agree in the main with those of the authors of the method.—B. W. KILGORE.

Molybdic solution as a reagent, G. MEILLÈRE (*Jour. Pharm. et Chim., ser. 6, 1896, No. 3, p. 61*).—It is stated that a solution which is widely applicable and will keep

many months without alteration may be prepared as follows: To 200 cc. of a 15 per cent solution of molybdate of ammonium solution add 20 cc. of dilute sulphuric acid (1 to 1) and 30 cc. of pure nitric acid. This solution is especially useful in determining small amounts of phosphoric acid and arsenic because it can be heated for a long time even as high as 100° C. without decomposition.

A method for the standardization of potassium permanganate and sulphuric acid, H. N. MORSE and A. D. CHAMBERS (*Amer. Chem. Jour., 18 (1896), No. 3, pp. 236–238*).—Having a sulphuric acid of known strength, add to a given amount of it in a beaker a small quantity of hydrogen peroxid, run in the permanganate solution to be standardized from a burette as long as the color disappears. Add more peroxid and then more permanganate until about 50 cc. of the latter has been reduced, leaving in the solution a minute excess of peroxid. Titrate the acid remaining free with $\frac{1}{10}$ normal ammonia with litmus as indicator. Calculate the permanganate in the amount of solution used by the equation $2KMnO_4+5H_2O_2+3H_2SO_4=K_2SO_4+2MnSO_4+8H_2O+5O_2$. The same process may be applied to the standardization of a sulphuric acid solution with a permanganate solution of known strength.

The measurement of colors of natural waters, A. HAZEN (*Jour. Amer. Chem. Soc., 18 (1896), No. 3, pp. 264–275*).

An improved gas regulator, F. P. DUNNINGTON (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 781–783, fig. 1*).

A new gas generator, E. P. HARRIS (*Jour. Amer. Chem. Soc., 17 (1895), No. 10, pp. 809, 810, figs. 2*).

Novelties in extraction apparatus, M. HAGEN (*Chem. Ztg., 19 (1895), No. 89, p. 2003, figs. 3*).

A new safety distillation tube for rapid work in nitrogen determination, C. G. HOPKINS (*Jour. Amer. Chem. Soc., 18 (1896), No. 3, pp. 227–229, fig. 1*).—The tube is designed for use in the Kjeldahl apparatus.

A convenient still for the laboratory, C. E. WAIT (*Jour. Amer. Chem. Soc., 17 (1895), No. 12, pp. 917–919, figs. 2*).

The agricultural station at Halle, E. SAILLARD (*Ann. Sci. Agron., ser. 2, 1896, I, No. 1, pp. 70–101*).—Principally a description of methods.

Report of Jönköping County Chemical and Seed-Control Station for 1894, C. VON FEILITZEN and C. O. VON PORAT (*Jonköping (Sweden), 1895, pp. 84*).

Report of Kalmar Chemical and Seed-Control Station for 1894, A. ATTERBERG (*Kalmar (Sweden), 1895, pp. 26*).

BOTANY.

On the adaptation of plants to an alpine climate, G. BONNIER (*Ann. sci. nat. Bot., ser. 7, 20 (1895), No. 1–6, pp. 217–360, pls. 12, figs. 28*).—The author has made an experimental study upon the anatomical and physiological changes induced in plants by transplanting them from the plain to elevations up to several thousand meters upon mountain sides. Thirty-five orders of plants, represented by about 90 genera and 120 species, were subjected to the conditions of the experiment, which was carried on for about 10 years. The plan of the experiment was to divide the roots or root stocks into equal parts, plant in the same kind of soil, and expose them to the conditions found at various stations upon the Alps and Pyrenees mountains, examining them from time to time for possible changes. Such changes as were noticed were attributed to more intense light, a drier atmosphere, and lower temperatures.

The author has given a résumé of the results shown by his experiments as well as those of other investigators as follows:

I. Modifications of form and structure. Under the effect of an alpine climate (1) the subterranean parts are relatively better developed than the aërial parts. (2) The rhizomes and roots are but little modified, except that the vessels are smaller and the cork earlier developed. (3) The aërial stems are shorter, more hairy, lie closer to the soil, are more spreading, and have shorter and fewer internodes. (4) In general the stems have a thicker cortex in proportion to the diameter of the axis cylinder; the epidermis is more cuticularized and its cell walls are thicker; often the epidermis is reënforced by layers of subepidermal cells; the tissues of the central cylinder are less differentiated. When bark exists it is usually thicker on branches of the same age. The secretory canals when present are relatively, sometimes actually, larger, and the stomata are more numerous. (5) The leaves are smaller, except occasionally in subalpine regions, more hairy, thicker in proportion to their area, often absolutely thicker, and are deeper green either by transmitted or reflected light. (6) The assimilating tissues of the blade of the leaf are better adapted for the exercise of their functions; the palisade tissue is developed to a greater extent either by narrowing and elongating their cells or by increasing the number of rows of cells; the cells contain a greater number of chlorophyll grains of a deeper green color; the secretory canals are, as in the case of the stems, larger, either actually or relatively; less differences are noticeable in the epidermis of the leaf than in the stem; however, it is generally better developed, especially on persistent leaves where the protective subepidermal cells are well developed. The epidermal cells are usually smaller and the number of stomata greater in proportion to the unit of surface. (7) The petioles show modifications analogous to those shown in the stem, but are less pronounced. (8) The flowers are relatively much larger, sometimes actually so, and more highly colored, whether due to chromoleucites or substances dissolved in the cell sap.

The author found in experiments with Teucrium that modifications in form and structure that were acquired by a plant removed from the plain to the mountain, or vice versa, would disappear in the same time if restored to its former climate.

II. Modifications of functions. (1) If a plant grown at an elevation be transported immediately to the level of one grown upon the plain, for equal surfaces and under the same conditions, the assimilation and chlorovaporization are greater for the leaves of the alpine plant. (2) If the same comparison be made of the respiration and transpiration taking place in darkness, for equal weights of plants these functions will have about the same intensity, or may be slightly less in the case of alpine plants.

On the assimilation of nitrogen from nitrates and ammonium salts by phanerogams, Y. KINOSHITA (*College Agr., Tokyo, Japan, Bul.,*

vol. 2, No. 4, pp. 200–202).—The author gives a preliminary report of his investigations as to the form in which the nitrogen of ammonium salts is stored up when these salts are absorbed in greater quantity than that required for the immediate use of the plant. Experiments were conducted with barley and maize, by which it was shown that the nitrates can be stored up as such, while the excess of nitrogen originally in the ammonium salts is stored up in the form of asparagin.

On the consumption of asparagin in the nutrition of plants, Y. KINOSHITA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 1, pp. 196–199*).—That asparagin is formed by the decomposition of proteids in plants has been frequently investigated, but the study of the regeneration of proteids from asparagin has been somewhat neglected. The author takes exception to the statement of C. O. Müller[1] that this process can take place only in the light during the processes of assimilation in the green leaves. Examples are given of the formation of proteids and protoplasm in complete darkness, as is the case with mold fungi, bacteria, etc. The author considers the relative amount of glucose or other suitable material as the most decisive factor in the transformation of asparagin into proteids. Shoots of soja bean, which are very rich in asparagin, were grown in darkness in solutions of calcium sulphate containing either methyl alcohol, glycerol, or glucose, and the amount of asparagin determined. Examinations were made for the presence of dissolved reserve albumen, and it was found that the decrease of asparagin was coincident with an increase in the amount of dissolved proteids.

The conclusions of the author show that methyl alcohol as well as glycerol can serve for the regeneration of proteids from asparagin, and that the process can go on in perfect darkness.

Does hydrogen peroxid occur in plants? J. CHO (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 1, pp. 225–227*).—The author reviews the work of A. Bach[2] and others relative to the existence of hydrogen peroxid in living plants. He subjected 21 species of plants to the same treatment as that described by Bach, and in 9 cases obtained a slight reaction; but he thinks that the coloration given can very probably be secured only in those cases where the leaves had been partially killed by the oxalic solution, and thus certain easily oxidizable organic matters had been made able to leave the cells by osmosis. These might by oxidation in the presence of anilin oxalate yield the colored products. The author doubts whether Bach observed the reaction in leaves that had remained alive in all parts.

On the reserve protein in plants, G. DAIKUHARA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 1, pp. 189–195*).—This paper is in continuation of a former one upon the same subject.[3] As all the material studied in the previous paper had been collected in the spring, it

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[1] Landw. Vers. Stat., 33, p. 11.

[2] Compt. Rend., 119 (1894), pp. 286, 1218 (E. S. R., 6, p. 615).

[3] College Agr., Tokyo, Japan, Bul., vol. 2, No. 2, pp. 79–96 (E. S. R., 6, p. 387).

occurred to the author that it would be interesting to examine the material collected during the fall. It was also desired to test leaves of evergreen plants and a number of fruits for the presence of reserve protein. All the material studied was collected during the months of October, November, and December.

The general result of the examination shows that objects not containing any active albumen as reserve material in the spring also show none in the autumn, and that most objects yielding positive results in the spring yield the same to a modified degree in the autumn. The results obtained by the examination of 22 orders represented by 37 species are given in tabular form.

Introduction to the study of fungi, B. D. HALSTED (*Science, n. ser., 3 (1896), No. 62, pp. 367, 368*).—A review is given of a recent work by M. C. Cooke upon this subject.

Investigations on the Hemibasidii, O. BREFELD (*Untersuchungen aus dem Gesamtgebiete der Mykologie: XII, pp. 236, pls. 7; abs. in Centbl. Bakt. und Par. Allg., 2 (1896), No. 2-3, pp. 79-91*).—This is in continuation of the author's studies on the smut fungi, about 60 forms being critically examined.

Morels and their allies, G. H. HICKS (*Asa Gray Bulletin, 4 (1896), No. 2, pp. 13-16, figs. 10*).

Mucor and Trichoderma, P. VUILLEMIN (*Compt. Rend., 122 (1896), No. 5, pp. 258-260*).

The soap bush (Sapindus utilis), L. TRABUT (*Bul. Agr. Alger. et Tunisie, 1 (1895), No. 14, pp. 315-324*).

Flowers and insects, C. ROBERTSON (*Bot. Gaz., 21 (1896), No. 2, pp. 72-81*).—Notes are given of the insect visitors observed to frequent Polygonum, Dirca, Euphorbia, Salix, and Iris, with copious bibliographical references.

On the physiology of Drosera rotundifolia, C. CORRENS (*Bot. Ztg., 54 (1896), No. 2, pp. 21-25*).

On the significance of fecundation among Uredineæ, SAPPIN-TROUFFY (*Compt. Rend., 122 (1896), No. 6, pp. 333-335*).

Germination of Uredo and Erysiphe spores in various culture media, F. RAUCH (*Inaug. Diss. Göttingen, 1895*).

On the development of the root systems of leguminous plants, C. FRUWIRTH (*Forsch. Geb. agr. Phys., 18 (1895), No. 5, pp. 461-479*).

On the development of the parasitic Exoasceæ, K. GIESENHAGEN (*Flora, 81 (1895), p. 207; abs. in Hedwigia, 35 (1896), No. 1, Repert., pp. 19, 20*).

The energy of the living protoplasm, O. LOEW (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 4, pp. 159-188*).—The author continues his studies on this subject, the chapters here given being upon the chemical activity of living cells and upon respiration.

On the ascent of sap (*Gard. Chron., ser. 3, 19 (1896), No. 478, p. 236*).—An editorial criticism is given of a paper upon this subject by H. H. Dixon and J. Joly in *Proc. Roy. Soc., 57 (1894)*. Their explanation is considered inadequate.

Experiments on the nutrition of green plants with methyl alcohol, tartaric, malic, and citric acids, R. HARTLEB (*Inaug. Diss. Erlangen, 1895, pp. 34; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 7, pp. 490, 491*).—The author found that under certain conditions methyl alcohol can be converted into starch by algæ, beans, and maize, but in itself it is not a suitable food material. Better results, however, followed the use of dilute acids.

Concerning the presence of pectase in plants and the preparation of this diastase, G. BERTRAND and A. MALLÈVRE (*Compt. Rend., 121 (1895), No. 21, pp. 726-728, and Jour. Bot. France, 10 (1896), No. 3, pp. 37-41; abs. in Bul. Soc. Chim. Paris, 15-16 (1896), No. 1, pp. 31-33; and Chem. Ztg., 19 (1895), No. 100, Repert., p. 394*).—A list is given of about 40 phanerogams and 5 cryptogams which were examined by the

authors. Pectase is found to be extensively distributed, being most abundant in the leaves, and it is probably distributed by them to other parts of the plant.

On the coloration of the tissues of the juice of certain mushrooms on exposure to the air, E. BOURQUELOT and G. BERTRAND (*Jour. Pharm. et Chim., ser. 3, 1896, No. 4, pp. 177–182*).

On the honeydew of leaves, G. BONNIER (*Compt. Rend., 122 (1896), No. 6, pp. 335–338*).

Concerning the absorption of light by marine algæ, N. WILLE (*Biol. Centbl., 1895, No. 14; abs. in Bot. Centbl., 54 (1896), II, No. 5, pp. 74, 75*).

Concerning the root tubercles of soja bean, O. KIRCHNER (*Cohn's Beitr. Biol. Pflanzen, 7 (1895), pp. 213–224, pl. 1; abs. in Centbl. Bakt. und Par. Allg., 2 (1896), No. 2–3, pp. 96, 97*).

White mustard as a nitrogen assimilator, S. KOWERSKI (*Inaug. Diss. Halle, 1895; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 7, pp. 539, 540*).—The author reviews some of the extensive literature on nitrogen assimilation, and from his experiments concludes that white mustard can not assimilate elementary nitrogen.

Australian fungi, D. MCALPINE (*Agl. Gaz. N. S. Wales, 6 (1895), Nos. 11, pp. 752–758; 12, pp. 850–857, pls. 3*).—Descriptions and critical notes are given of 24 species of fungi, most of which are new. Most of the new species belong to the Uredineæ.

Plant breeding (*Gard. Chron., ser. 3, 19 (1896), No. 480, p. 300*).—An editorial review is given of L. H. Bailey's recent work upon this subject (E. S. R., 7, p. 562).

On the evolution of cultivated plants, M. T. MASTERS (*Nature, 53 (1896), No. 1373, pp. 363, 364*).—A review is given of Plant Breeding by L. H. Bailey.

On the use of oxalic acid in preserving the color of dried plants, J. H. SCHROEDER (*Amer. Jour. Pharm., 68 (1896), No. 3, pp. 132–134*).

Report of the botanist, A. D. SELBY (*Ohio Sta. Rpt., 1894, pp. XL–XLII*).—A brief statement is given of the work projected and accomplished during the previous year.

Report upon some Mexican Umbelliferæ, J. M. COULTER and J. N. ROSE (*U. S. Dept. of Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 3, No. 5, pp. 289–309, pls. 6*).—Critical notes and descriptions are given of some Mexican Umbelliferæ, mostly from the State of Oaxaca, collected by C. G. Pringle and E. W. Nelson during 1894.

Descriptions of plants, mostly new, from Mexico and the United States, J. N. ROSE (*U. S. Dept. of Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 3, No. 5, pp. 311–328, pls. 6*).—Descriptions of new species of plants from miscellaneous collections together with critical notes upon others are given. The paper also contains descriptions of new species of Malvaceæ by E. G. Baker and of Cucurbitaceæ by A. Cogniaux.

Herman Hellriegel, his life and his work, H. WILFARTH (*Landw. Vers. Stat., 46, No. 6, pp. 441–450, pl. 1*).—An account of the life and work of the late director of the Bernburg Experiment Station, so widely known for his discoveries in connection with the nitrogen assimilation of legumes, prepared by his first assistant in this work. A picture is given of Professor Hellriegel and a list of his published papers.

FERMENTATION—BACTERIOLOGY.

On the presence of a glucose-forming and the absence of a saccharose-inverting enzym in malt, E. KRÖBER (*Ztschr. ges. Brauw., 1895, No. 18, p. 337; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 329*).—Lintner observed that dextrose was formed by the action of malt extract or precipitated diastase on starch. As Morris has denied the presence of glucose in malt, the author undertook an investigation to

determine the presence of a dextrose-forming enzym in malt and the conditions under which it acts. The results were as follows:

(1) Malt contains dextrose, sucrose, probably levulose, but no maltose.

(2) The absolute and relative amounts of dextrose and sucrose are very variable.

(3) In malt extracts (prepared at 15° and 55°) no ferment which inverts sucrose was found.

(4) Malt contains a dextrose-forming ferment which seems to act most energetically at 55°.

(5) Roasting changes the reducing sugars in malt to products having a smaller reducing power.—W. H. KRUG.

On the enzyms of some yeasts, E. FISCHER and P. LINDNER (*Wochenschr. Brauerei, 1895, p. 959; abs. in Chem. Ztg., 19 (1895), No. 88, Repert., p. 331, and in Centbl. Bakt. und Par. Allg., 1 (1895), No. 25, pp. 889, 890*).—The bottom yeasts (type Frohberg and Saag) contain an enzym which breaks up melibiose, while the surface yeasts of the same type have no appreciable action. As the latter contain considerable invertin, this result was a direct contradiction of Scheibler and Mittelmaier's statement that melibiose is completely split up by the continued action of invertin. The experiments were therefore repeated, and it was found that even large amounts of very active invertin had no action on melibiose.—W. H. KRUG.

Practical studies in fermentation, E. C. HANSEN, translated by A. K. MILLER (*New York: Spon & Chamberlain, 1896*).

Concerning the fungi which form the transition between the molds and Saccharomycetes and those which appear in malt, A. JÖRGENSEN (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 2-3, pp. 41-44*).

The rôle of bacteria in nature, G. FRANK (*Jahrb. Nassau. Vereins Naturkunde, 48 (1895), pp. 1-1?; abs. in Centbl. Bakt. und Par. Allg., 2 (1896), No. 2-3, p. 78*).—A popular article on the presence and importance of bacteria in nature.

The relation of bacteria and their toxins, E. KLEIN (*Lancet, 1895, Jan. 5; abs. in Centbl. Bakt. und Par. Med., 19 (1896), No. 8, p. 297*).

Bacteria on grain (*Deut. landw. Presse, 23 (1896), No. 15, p. 121*).—Popular notes are given of the danger to man and beast from bacteria carried on grain from one country to another.

A simple method for bacterial examination of the air, P. MIQUEL (*Ann. Micr., 7 (1895), p. 103; abs. in Centbl. Bakt. und Par. Med., 19 (1896), No. 8, pp. 296, 297*).

A review of the works on bacteria and fermentation published during 1892, L. BOUTROUX (*Rev. gén. Bot., 7 (1895), Nos. 77, pp. 216-232; 78, pp. 270-277*).

On the study of the micro-fungi, W. THOMSON (*Internat. Jour. Micr. and Nat. Sci., ser. 3, 5 (1895), No. 28, pp. 360-381, pl. 1*).

On the biology of Bacillus ramosus, a schizomycete of the Thames River, H. MARSHALL WARD (*Proc. Roy. Soc., 58 (1895), No. 351, pp. 265-468*).

Concerning a nitrogen-forming bacillus growing on gelatin, R. BURRI and A. STUTZER (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 20-21, pp. 721-740*).

Concerning the relation of Proteus vulgaris to the ammoniacal decomposition of urea, A. BRODMEIER (*Centbl. Bakt. und Par. Med., 18 (1895), No. 12-13, pp. 380-391*.

On the characterization of Duclaux's Tyrothrix spp.—their variability and relation to peptonizing and lactic acid bacteria, W. WINKLER (*Centbl. Bakt. und Par. Allg., 1 (1895), Nos. 17, pp. 609–619; 18–19, pp. 657–674, pls. 2*).

The mineral nourishment of the lower fungi, H. MALISCH (*Sitzungsber. kgl. Akad. wissensch. Math. natur. Classe Wein, 103 (1894), No. 8, pp. 554–574*).

On the resistance of the spores of bacteria to humid temperatures of 100° C. and over, P. MIQUEL and E. ZATTRAYE (*Ann. Micr., 7 (1895), Nos. 3, pp. 110–122; 4, pp. 158–170*).

The use of pasteurization to prevent the after-fermentation of wine in the bottles, C. SCHULZE (*Landw. Jahrb., 24 (1895), No. 3, pp. 403–433*).

Studies on the effect of organic acids on alcoholic fermentation, F. LAFAR (*Landw. Jahrb., 24 (1895), No. 3, pp. 445–474*).

Concerning the origin of alcoholic ferments, A. JÖRGENSEN (*Ber. Gährungs. Lab. Copenhagen, 1895; abs. in Hedwigia, 34 (1895), No. 5, Repert., pp. 152, 153*).

Concerning the granulation of yeast cells, S. EISENSCHITZ (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 18–19, pp. 674–680*).

Experimental studies on the variation of yeast cells, E. C. HANSEN (*Ann. Bot., 9 (1895), No. 36, pp. 549–560*).

A new enzym of yeast, A. BAU (*Chem. Ztg., 19 (1895), No. 83; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 25, pp. 887–889*).

Preliminary note on sake yeast, K. YABE (*College of Agr., Tokyo, Japan, Bul., vol. 2, No. 4, pp. 219, 220*).—The author has made investigations of the fungus causing the alcoholic fermentation in boiled rice, and concludes that the sake yeast is not a stage of development of Eurotium, but a distinct species.

Experimental investigations on the supposed metamorphosis of Aspergillus oryzæ, A. KLÖCKER and H. SCHIÖNNING (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 22–23, pp. 777–782*).

A study of Aspergillus oryzæ, E. SORREL (*Compt. Rend., 121 (1895), No. 25, pp. 948–950*).

On the endospore formation and general description of a red yeast, A. P. SWAN (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 1, pp. 1–11, figs. 8*).—A study is given of *Saccharomyces roseus*.

Fractional fermentation of sucrose by pure yeasts, HIEPE (*Jour. Federated Inst. Brewing, 1895, p. 288; Wochenschr. Brauerei, 1895, p. 983; abs. in Chem. Centbl., 1895, II, p. 934*).

On the fermentation of cellulose, V. OMELIANSKI (*Compt. Rend., 121 (1895), No. 19, pp. 653–655; Jour. Phar. et Chim., ser. 6, 15 (1895), No. 12, pp. 554–558*).

A study of some gas-producing bacteria, A. A. BENNETT and E. E. PAMMEL (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, pp. 157–166, fig. 1*).

Preliminary note upon the structure of bacterial cells, H. WAGER (*Ann. Bot., 9 (1895), No. 36. pp. 659–661*).

The formation of bacterial colonies, H. MARSHALL WARD (*Ann. Bot., 9 (1895), No. 36, pp. 653–657*).—The author thinks variations in form, rate of growth, size, color, etc., in plate cultures are subject to slighter changes in gelatin and environment than hitherto recognized. Regarding water as the medium, a bacillus may have stamped upon it such differences that plate colonies may differ widely with season or length of time the germ has been isolated. Owing to these variations, it is often difficult to recognize species, etc.

Concerning bacterial colonies, M. JEGUNOW (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 1, pp. 11–21, figs. 6*).

Concerning the liquefaction of gelatin by fungi, C. WEHMER (*Chem. Ztg., 19 (1895), No. 91, p. 2088; abs. in Centbl. Bakt. und Par. Allg., 2 (1896), No. 2–3, pp. 92–96*).

Solubility and activity of soluble ferments in alcoholic solutions, A. DASTRE *Compt. Rend., 121 (1895), No. 24, pp. 899–901*).

The influence of lecithin on the growth and multiplication of organisms, B. DANILESKY (*Compt. Rend., 121 (1895), No. 27, pp. 1167–1170*).

On the action of benzin on microörganisms, A. CHASSEVANT (*Compt. Rend. Soc. Biol., 1895, No. 29, pp. 698, 699*).

A contribution on the use of formalin, G. BURCKHARD (*Centbl. Bakt. und Par. Med., 18 (1895), No. 9–10, pp. 257–264*).

A method of hermetically sealing cultures of bacteria, C. F. DAWSON (*Amer. Micr. Jour., 16 (1895), No. 10, pp. 322–324*).

Concerning the use of soja beans for fungus culture media, M. MIYOSHI (*Bot. Mag. Tokyo, 9 (1895), pp. 361–365*).

Staining Bacillus tuberculosis in milk (*Jour. Amer. Micr. Soc., 17 (1896), No. 1, p. 40*).—The method consists of adding to a drop of milk on a glass slip 2 or 3 times its bulk of a 1 per cent solution of sodium carbonate. The mixture is to be well stirred and slowly dried over an alcohol flame. The subsequent treatment is that for ordinary staining.

A new tube for the culture of anaërobic microörganisms, F. JEAN (*Jour. Amer. Micr. Soc., 17 (1896) No. 1, pp. 8, 9, fig. 1*).

A handy contrivance for sterilizing fluid culture media, R. KRETZ (*Centbl. Bakt. und Par. Med., 19 (1896), No. 2–3, pp. 73, 74, fig. 1*).

A new sterilizer, R. BURRI (*Centbl. Bakt. und Par. Med., 18 (1895), No. 25, pp. 783, 784, fig. 1*).

METEOROLOGY.

Meteorological summary for Ohio, 1894, C. A. PATTON (*Ohio Sta. Bul. 58, pp. 117–127*).—Notes on the weather and tabulated daily and monthly summaries of observations at the station on temperature, precipitation, cloudiness, direction of the wind, etc., are given; and for comparison similar data for previous years and for other parts of the State are added. The following is a summary of results:

Summary of meteorological observations.

	For the experiment station		For the State.	
	1894	For 7 years.	1894	For 12 years
Temperature (°F.):				
Mean	50.5	49.3	52.40	50.60
Highest	98 (July 19)	99 (Aug. 8, '91)	105 (July 18, 19)	108 (July 18, '87)
Lowest	—7 (Dec. 28)	—20 (Jan. 20, '92)	—27 (Dec. 29)	—34 (Jan. 25, '84)
Range	105	119	132	133
Mean daily range	22.9	20.1	23	20.3
Greatest daily range	45 (July 31)	46 (July 7, '92)	60 (Oct. 19)	60 (Oct. 19, '94)
Least daily range	4 (Dec. 1, 23)	2 (Jan. 6, '89)	1 (Feb. 7)	0.5 (Dec. 23, '83)
Clear days	127	115	138	115
Fair days	154	129	126	124
Cloudy days	84	114	101	128
Days rain fell	130	127	100	128
Rainfall (inches):				
Total	30.60	40.14	29.75	38.52
Greatest monthly	4.41 (May)	7.89 (June, '92)	......	....
Least monthly	0.76 (Aug.)	0.37 (Oct., '92)	....	....
Mean daily	......	......	0.08	0.105
Direction of wind	NW.	S.	SW.	SW.

Frost, how and when to prevent injury, W. H. HAMMON (*California Fruit Grower, 18 (1896), No. 6, pp. 102, 103*).

The diurnal oscillation of atmospheric pressure at the Peruvian stations of Harvard College Observatory, S. J. BAILEY (*Amer. Met. Jour., 12 (1896), No. 11, pp. 331–335, dgms. 4*).

The physical phenomena of the upper atmosphere, A. CORNU (*Rev. Sci., ser. 4, 5 (1896), No. 7, pp. 200–207, figs. 8*).

Cyclones and anticlones, H. A. HAZEN (*Amer. Met. Jour., 12 (1896), No. 11, pp. 336–351, dgm. 1*).

Third ascension to the observatory of Mont Blanc, J. JANSSEN (*Rev. Sci., ser. 4, 5 (1896), No. 9, pp. 257–259*).

The observatory on Mont Aigonal, G. FABRE (*Compt. Rend., 122 (1896), No. 9, pp. 553–556*).

The measurement of temperature at distant points, C. F. MARVIN (*Amer. Met. Jour., 12 (1896), No. 11, pp. 359, 360*).—A note on a form of electrical thermometer identical with that of Eschenhagen described by Bamer in an earlier number of the journal, which is claimed to have been used by the United States Signal Office 10 years before Eschenhagen's apparatus was described.

AIR—WATER—SOILS.

On the percentage of argon in the atmosphere and respired air, A. KELLAS (*Proc. Roy. Soc., 59 (1896), No. 353, pp. 68, 69*).—Using a method by which the presence of water was avoided, the amount of argon in atmospheric air was redetermined. One hundred cubic centimeters of air was found to contain 0.937 cc. of argon. From this it was calculated that 100 cc. of mixed atmospheric nitrogen and argon contained 1.186 cc. of argon.

Air was analyzed before it was breathed and found to have the normal composition, i. e., 79.02 per cent of nitrogen and argon. Air was breathed over and over for 10 minutes by a man and was then found to contain 80.96 per cent of nitrogen and argon. The amount of argon in respired air was determined, and 100 cc. contained 0.980 cc. of this gas. One hundred cubic centimeters of nitrogen and argon from respired air was found by calculation to contain 1.21 cc. of argon. This percentage is a little larger than that in normal air.

In the author's opinion two suppositions are possible to account for the slight increase in argon: (1) Either it is due to the fact that the air was confined over water during breathing, or (2) a greater amount of argon is given off from the blood than is absorbed. The former supposition is, in the author's opinion, the more probable, and the conclusion is reached that "argon, like free nitrogen, plays no important part in the animal economy save as a diluent."

On the amount of ammonia which hydrochloric acid will absorb from the atmosphere in the course of a year, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 10–18*).—The experiments on this subject were made in the following manner: In a glass vessel 5 cm. high and 10 cm. in diameter 20 per cent hydrochloric acid was placed and left exposed to the air for one month. The vessel was protected from rain by a cover, which permitted the free access of the air. The vessel was placed in an open field 42.5 meters from the experiment station building and distant from other houses about 1,000 meters. At the end of each month the hydrochloric acid was evaporated to dryness and ammonium chlorid determined in the residue by means of the

Knopf azotometer. The results show that the total amount of nitrogen absorbed during the year was 24.068 mg., but that the amounts varied widely in the different seasons of the year, the highest amount being obtained in June, 4.061; the lowest in February, 0.854. For the different seasons the following amounts were obtained: December, January, and February, 2.912 mg.; March, April, and May, 6.712 mg.; June, July, and August, 9.766 mg.; September, October, and November, 4.678 mg. The total amount found for the year is much smaller than that reported by Schlössing. But the latter made observations only during a few weeks in the warm season.

There was no indication, as Schlössing has suggested, that the ammonia of the atmosphere is in any way influenced by the proximity of water, for when the wind was blowing from the direction of a large body of water there was no increase in the amount of ammonia absorbed.

The microscopical examination of water, W. J. DIBBIN (*Analyst, 21 (1896), No. 238, p. 2*).—The author discusses the importance of the microscopical examination of the suspended matter in drinking waters and describes his own method of collecting the suspended matter and examining it. The results of a number of chemical analyses of waters and microscopical examinations are given.—B. W. KILGORE.

Note on the behavior of hippuric acid in soils, K. YOSHIMURA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 2, pp. 221–223*).—Experiments are reported on two soils, one a clayey soil, the other volcanic ashes containing 8 per cent of humus and 8 to 11 per cent of oxid of iron, and both almost free from calcium carbonate, which showed that "hippuric acid and its sodium salt are not absorbed by the soils tested. Decomposition of hippurates proceeds more quickly in the surface soil than in the subsoil; this decomposition is attended with liberation of ammonia and is chiefly dependent upon the action of micrococci."

The depth of the surface soil and its relation to various agricultural operations, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 35–43*).—Galvanized iron boxes 40 cm. deep and 30 cm. square were filled with a poor sandy soil. Two of the boxes were unmanured, 2 were liberally manured with a complete fertilizer, which was only mixed with the upper 10 cm. of the soil; 2 received the same fertilizer mixed to a depth of 20 cm.; and 2 the same fertilizer mixed to a depth of 40 cm. The concentration of the plant food furnished in the different fertilizers was in the ratio of 1, ½, and ¼. Oats and lupines were grown in these boxes with the following results:

Effect of the concentration of fertilizer solutions on the growth of plants.

	Without fertilizer.	Fertilizer concentration. 1.	½.	¼.
	Grams.	*Grams.*	*Grams.*	*Grams.*
Oats, straw, and chaff	12.1	60.1	52.0	47.6
Oats, grain	10.1	46.0	33.8	29.8
Yellow lupines, straw, and hulls	167.8	76.3	128.1	145.1
Yellow lupines, seed	39.3	22.5	38.9	40.8

The following conclusions are drawn from these results:

(1) The nutrition of plants is best secured when the plant food in the soil and in the water is of a particular degree of concentration.

(2) The productiveness of the soil depends upon the concentration of the plant food and not upon the absolute amounts present.

(3) Where a small amount of manure is available the greatest returns will be obtained by applying it as top dressing, provided the weather conditions are favorable, since by this means the greatest concentration of plant food is secured.

(4) Deep culture without increased manuring is injurious, since by this means the concentration of the plant food is lessened and the nutrition of the plant is interfered with.

(5) Deep culture with an increase of the concentration of the plant food increases the yield.

Investigation of Courland soils, G. THOMS (*Beilage Düna Ztg., 1895, Nos. 205, pp. 141–143; 211, pp. 145–147; 217, pp. 149–151*).—The results of a study of a third series of 14 Courland soils in continuation of work previously published (E. S. R., 6, p. 513) are here reported and tend to confirm the conclusions drawn from the earlier investigations. Additional points of minor importance, brought out by the more recent researches, are that the magnesia as well as the phosphoric acid stands in direct relation to the productiveness of the soil, the average water content of the poor soil is higher than that of the better class, and the absorptive power of the subsoils for ammonia was invariably greater than that of the surface soils. In the valuation of the soils based upon chemical examination the medium and poor soils stand equally high but considerably lower than the good soils, thus emphasizing the importance of taking the physical properties of a soil into account in judging its agricultural value.

The past, present, and future water supply of London, E. FRANKLAND (*Chem. News, 73 (1896), No. 1891, p. 99*).

London water supply, W. COOKES and J. DEWAR (*Chem. News, 73 (1896), No. 1884, p. 4; and No. 1889, p. 65*).—Report of the composition and quality of the water supplied to London during November and December, 1895.—B. W. KILGORE.

On the reduction of nitrates in arable soil, E. BRÉAL (*Ann. Agron., 22 (1896), No. 1, pp. 32–37*).—The results of the work here reported confirm Wagner's conclusion that manure may exert a denitrifying action in the soil and indicate that this is due to the action of the denitrifying organisms found by the author to be generally present in straw and similar substances (E. S. R., 3, p. 916), which are used in large quantities in manure. Nitrification in the soil was almost entirely checked by irrigation with a water extract of straw. It is suggested that the contrary results obtained by Pagnoul may be explained by supposing that the addition of the large amount of manure so accelerated the action of the nitric ferment that the influence of the denitrifying ferment was masked.

Moorlands and their culture in Bavaria, A. BAUMANN (*Forstl. Naturw. Ztschr., 5 (1896), No. 1, pp. 15–32, pls. 2*).—Remarks on origin, flora, and redemption.

Moor culture at Meilgaard (Denmark), L. JÖRGENSEN (*Tidskr. Landökon., 14 (1895), pp. 469–501*).

Moor culture in Denmark (*Tidskr. Landökon., 14 (1895), pp. 660–696*).

Steppes, deserts, and alkali lands, E. W. HILGARD (*Pop. Sci. Monthly, 1896, Mar., pp. 602–616, pls. 5*).

Analyses of soils from Lake Temiscamingue district, A. E. SHUTTLEWORTH (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 34, 35*).—A complete analysis of a clay soil and a partial analysis of a humus soil.

The influence of the evolution of sulphuric anhydrid on the soil and on agricultural production, A. DAMSEAUX (*Ann. Sci. Agron., ser. 2, 1896, 1, No. 1, p. 121*).

Studies of plant growth as related to aëration of the soil, L. MANGIN (*Ann. Sci. Agron., ser. 2, 1896, 1, No. 1, pp. 1–68, figs. 8.*)—The studies were confined principally to the parks and promenades of Paris.

On the circulation of air in the soil, P. P. DEHÉRAIN and E. DEMOUSSY (*Compt. Rend., 122 (1896), No. 3, pp. 109–112*).—It is explained that the soil is composed principally of small aggregates of sand cemented together by clay flocculated by lime. Free circulation of air and water is assured to the extent that those aggregates resist the puddling action of rain. When the aggregates are broken up the soil becomes impermeable. The corrective for this condition is the application of lime, marl, or other calcareous manure.

The fixation of the dunes of Sahara, P. PRIVAT-DESCHANEL (*Rev. Sci., ser. 4, 5 (1896), No. 9, pp. 275, 276*).

Reclaiming sand barrens (*Forester, ? (1896), No. 2, p. 26*).—A reprint from the *Northeastern Lumberman* is given, in which is stated the progress made in reclaiming the sand barrens of Cape Cod, Massachusetts.

FERTILIZERS.

Investigations on the determination of the fertilizer requirements of arable soils and cultivated plants, G. LIEBSCHER (*Jour. Landw., 43 (1895), No. 1–2, pp. 49–216*).—After a somewhat detailed discussion of methods of field experiment and a review of the work of different investigators in this line, the author reports the results of pot and field experiments at Göttingen and field experiments with fertilizers in a number of different localities on oats, barley, wheat, rye, potatoes, peas, beans, and beets. The general conclusion is drawn that field experiments, even on small plats from 1 to 1½ ares[1] in size, are capable of showing, with considerable degree of accuracy, the fertilizer requirements of different soils and plants, but that such experiments should, as a rule, be accompanied by parallel experiments in pots, in which the different conditions affecting the plant growth are under better control. The experience of the author indicates that pot experiments properly conducted give results from which practical conclusions in many cases may be safely drawn. It is true that the conditions are, as a rule, such that the results are exaggerated, and the experiments have not the same value for popular instruction as field experiments. If the former are not carefully conducted—for instance, if excessive amounts of water are used—the results may be rendered practically worthless on account of their abnormal character, due to the large amount of fertilizing material which the water dissolves from the soil and furnishes the plant. Exaggeration of results is also partly due

[1] 119.6 to 179.4 sq. yd.

to more favorable temperature maintained in the pots than in the soil *in situ*. Observations are reported which show, as a rule, much higher temperature in the pots than in field soil. This, of course, contributes to a more vigorous growth of root and more active assimilation of plant food in the pots than in the field soil. With a given amount of plant food the soil in the pot is therefore enabled to produce a larger growth of plants than the field soil, this being in some cases from three to four times as great.

The results of comparisons of methods proposed by Märcker and Dyer for determining the assimilable plant food in the soil agreed fairly well with those obtained in the fertilizer experiments. It was, moreover, found that the ordinary method of extraction, boiling in concentrated hydrochloric acid, gives results more suggestive of the actual requirements of the soil than is ordinarily assumed. Indeed, in the experiments made by the author the results by this method gave direct indications of the soil deficiencies, which fertilizer experiments afterwards confirmed.

It was found that 0.15 per cent of potash in the soil indicated a deficiency of this element, and showed the necessity of heavy manuring with potash fertilizers, especially in case of plants which particularly require potash. The soils with from 0.2 to 0.4 per cent of potash were moderately deficient in potash. In systems of farming where an abundance of manure is used such a soil would need moderate applications of potash on potatoes and similar crops. Without manure such soils would require liberal potash fertilizing for such crops. With 0.5 per cent of potash, applications of potash fertilizers in addition to manure is probably unnecessary.

As regards the content of phosphoric acid, it appears that the solubility is of more significance than the total amount present. It is also important to consider the demands of the crop to be grown with regard to this element. With a high content of sesquioxids a soil will show great need of phosphatic fertilizers, although it already contains a high per cent of phosphoric acid. A soil containing the same amount of phosphoric acid with a low percentage of the sesquioxids would give little return for applications of phosphatic fertilizers. In determining the requirements of a soil, therefore, with reference to phosphoric acid we must take into account not only the solubility of the phosphoric acid but also the amount of iron oxid and alumina present. With these qualifications it may be stated that with a phosphoric acid content of about 0.07 per cent or less a soil may be considered deficient in this element; one containing from 0.07 to 0.085 per cent, of only medium quality; from 0.085 to 0.1, satisfactory; from 0.1 to 0.2, good; and higher than this, rich. This is practically the same classification independently arrived at by Märcker.[1] It may be considered a satisfactory con-

[1] Ztschr. landw. Cent. Ver. Sachsen, 1890.

dition if in the soil solution one part of phosphoric acid is associated with less than 40 parts of iron oxid and alumina, less favorable when the ratio is 1:40–60, still less so when it is 1:60–90, and very unfavorable when it is 1 to over 90.

An important consideration in experiments with fertilizers is their influence upon the moisture rendered available to plants.[1] The variations which may occur in this respect under different systems of fertilizing are indicated by the results obtained with oats grown in pots on clay and sandy soils, which are given in the following table:

Water required to produce 1 gram of air-dry oats on different kinds of soil.

	Water required by 1 gram of air dry substance							
	With potash	With nitrogen.	With phosphoric acid	With potash, nitrogen and phosphoric acid	Nothing	With potash and nitrogen	With potash and phosphoric acid	With phosphoric acid and nitrogen
	Grams	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*	*Grams*
Clay soil	344	311	269	173	340	319	265	176
Sandy soil	312	194	306	178	332	192	299	192

These figures show a much lower amount of water per unit of dry matter than those reported by Hellriegel, but the total production was decidedly lower in Hellriegel's experiments, and this may explain the difference in the amount of water required. The smallest amount of water, it will be observed, was required in the case where the complete fertilizer was used. Potash apparently did not exert any great influence in this respect, but both nitrogen and phosphoric acid were very effective, especially when used in combination.

The results also show that by the proper use of fertilizers the water consumption may be very greatly reduced without diminishing total production. This saving of water may amount in round numbers to 40 per cent of the total amount required, although with hoed crops it is not likely to be more than from 5 to 10 per cent.

From these facts it follows that fertilizers are of much more importance in a dry year than in one in which moisture is supplied in the best amounts. We also find here the explanation of the fact that plants grown in pots with abundance of moisture required much smaller amounts of potash and phosphoric acid than those grown in the field during 1894. In other words, plants surrounded by proper conditions of water, light, and heat require less mineral plant food to produce normal growth than those not so favorably situated with regard to these factors. With a minimum of a given factor of production a plant will produce a greater yield the more nearly the other factors of production approach the optimum.

[1] The forms of fertilizer used are not stated, but from another source of information it appears probable that carbonate of potash, nitrate of soda, and precipitated phosphate were used.

The taking up of fertilizing materials by the potato plant with different fertilizers, L. HECKE (*Jour. Landw., 43 (1895), No. 3, pp. 285–332, dgms. 2*).—Previous European work in this line is reviewed and the varying demands of different crops on the fertility of the soil are discussed. In the study of this subject the author used a marly loam soil which was rich in phosphoric acid but somewhat deficient in nitrogen and potash.

Eight 50 sq. cm. plats were used, which for several previous years had been fertilized in the spring as follows: (1) Carbonate of potash, 3 kg.; (2) nitrate of soda, 1.5 kg.; (3) precipitated phosphate of lime, 3 kg.; (4) the same as 1, 2, and 3; (5) unmanured; (6) the same as 1 and 2; (7) the same as 1 and 3; and (8) the same as 2 and 3. On plats 1, 4, 6, and 8 the nitrogen was increased to 3 kg. per plat to insure an excess of this element. The plats were planted to potatoes.

The experiment was divided into 5 periods, namely, April 21 to June 21, June 21 to July 11, July 11 to August 2, August 2 to August 22, August 22 to September 12, a portion of the crop on each plat being gathered and examined at different dates.

From the results obtained the following conclusions are drawn: The potato throughout its period of growth requires liberal supplies of all three of the fertilizing elements. The demand for nitrogen is especially strong in the first half and for potash in the second half of the vegetation period. The assimilation of plant food, as well as the production of dry matter, was always influenced by the manuring, although in some cases to a very slight extent. Applying potash increased the assimilation of potash in the first half and lowered it in the second half of the period of growth.

The influence of potash was especially marked in the production of tubers and roots, although observed in all parts of the plant. The conclusion of other investigators that potash assists in the formation of starch was in a measure confirmed. Its use always increased the potash content of the plant and seemed to promote the assimilation of nitrogen. The application of nitrogen alone always increased the nitrogen of the plants, but when phosphoric acid and potash were used in connection with the nitrogen the nitrogen content was lowered. As a rule the influence of applications of phosphoric acid was less significant and uniform than that of potash and nitrogen, probably because the soil was already well supplied with this element.

It is not certain that from the progress of the assimilation of plant food it is possible to draw conclusions regarding the deficiencies of soils and fertilizers. The diagram of the results, however, indicate a deficiency of nitrogen in the first half of the period of growth, and of potash and phosphoric acid during the second half. Since the assimilation of fertilizing constituents was not suspended under the influences of manuring, this process must be looked upon as a constant characteristic which may serve to differentiate the manurial requirements of our cultivated plants.

The improvement of light lands by green manuring (*New Jersey Stas. Rpt. 1894, pp. 128-132*).—Two experiments are noted, one of which (at Allaire, New Jersey) has been carried on for 2 years and was described in the Annual Report of the station for 1893 (E. S. R., 6, p. 794), in which results with crimson clover followed by cowpeas were given. The cowpeas were followed by winter rye, which was turned under as a preparation for corn followed in turn by crimson clover. The yield of corn was greatly reduced by drought. Analyses with reference to food constituents and draft on the soil fertility are given for kernels, cobs, and stalks.

"There is already a very noticeable improvement in the physical character of the soil; it now corresponds to a medium rather than a sandy loam. The plan contemplates plowing down the crimson clover in May, and planting potatoes with a light dressing of the mineral elements only, relying upon the accumulated organic matter provided by the crops of cowpeas and rye for the necessary nitrogen."

The second experiment in progress at Moorestown, New Jersey, was planned to study—

"(1) The effect of green manures in connection with the mineral fertilizers upon the development of poor land; (2) the relative effect of ground bone and South Carolina rock superphosphate as sources of phosphoric acid, and (3) the relative effect of muriate of potash and kainit as sources of potash.

"The experiment included 3 plats, each one-quarter of an acre in area, and treated as follows: Plat No. 1, muriate of potash 40 lbs., ground bone 63 lbs.; plat No. 2, muriate of potash 40 lbs., South Carolina rock superphosphate 100 lbs.; and plat No. 3, kainit 125 lbs., South Carolina rock superphosphate 100 lbs.

"The surface soil and the subsoil to a considerable depth are composed of rather coarse sand, and are poor both in physical and chemical properties. In good seasons the land, if well manured, produces only medium crops of melons and sweet potatoes, but which are of exceptionally good quality."

The results with black cowpeas are briefly reported, but are unsatisfactory on account of insects and drought.

"The plan adopted provides that the rye shall be plowed down in the spring of 1895 and the plats planted with sweet corn, the kind and amount of fertilizers for the different plats to be the same as in 1894, and crimson clover seeded in the corn."

Fertilizers (*New Jersey Stas. Rpt. 1894, pp. 17-97, 207, 208*).—Much of the data here reported has already appeared in Bulletins Nos. 102 and 104 of the station (E. S. R., 6, pp. 396, 706). The article includes statistics of the amount and value of fertilizers used in New Jersey in 1894; a comparison of the year's trade with that of previous years; data relating to the market prices of commercial fertilizers; notes on the economic purchase and rational use of incomplete fertilizers, and on home mixing of fertilizers; text of the State fertilizer laws, with directions for sampling; and tabulated analyses and valuations of 270 samples of fertilizing materials, including home-mixed and factory-mixed fertilizers, nitrate of soda, sulphate of ammonia, dried blood, dry ground fish, cotton-seed meal, ground bone and tankage, ground bone, dissolved boneblack, South Carolina rock and other mineral phosphates, muri-

ate of potash, sulphate of potash, kainit, muck, sewage sludge, ground horn, nitrate-bearing clay from Egypt, tobacco dust, tobacco leaf, wool waste, and garbage ashes.

Replies by 81 manufacturers to a circular of inquiry sent out by the station indicate a total consumption of fertilizers in the State during the year of 53,469 tons, valued at $1,715,767, the sales being the largest recorded by the station. Of this amount 39,319 tons, or 73 per cent of the total amount, representing an expenditure of $1,350,000, or 78 per cent of the total value, was for complete fertilizers.

"Although it is admitted that these statistics are incomplete, as they represent only about four-fifths of the manufacturers who sell fertilizers in this State, yet the number of manufacturers who did reply to our inquiries this year is greater than ever before. These 81 firms represent the greater part of the fertilizers sold in the State; those manufacturers who have not replied, as a rule, being those whose total output averages less than 50 tons per annum."

The statistics show that there has been a decline in prices of complete fertilizers since 1885, but that this decline has not been "accompanied by a corresponding decrease in the absolute amounts of plant food delivered to consumers."

"The home mixtures examined represent the purchase of at least 800 tons; the average cost was $30.85 and the average valuation $34.16, or a gain of $3.31 per ton over station's valuations, which are intended to, and actually do, fairly represent the retail cash cost of the fertilizer constituents in the raw materials at factory. The cost per ton was 10.7 per cent less than the valuations; in the manufacturers' mixtures examined in 1893 it was shown that the cost per ton was 40 per cent greater than the valuations."

Analyses of Swedish Thomas phosphates, C. VON FEILITZEN (*Svenska Mossk. Fören. Tidskr., 1895, pp. 207, 208*).—The author gives the following analyses of Thomas phosphate, manufactured at Domnarfvet, Sweden, and for the sake of comparison analyses of 3 samples of imported slag:

Analyses of samples of Thomas slag.

	Manufactured in Sweden			Imported slag.		
	No. 1.	No. 2.	No. 3	No. 4.	No. 5.	No. 6.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Total phosphoric acid	17.27	17.81	19.79	17.73	17.81	22.08
Phosphoric acid soluble in ammonium citrate (Wagner's method)	12.75	12.49	13.24	10.93	13.90	12.29
Proportion of total phosphoric acid soluble in ammonium citrate	78.83	70.13	66.90	61.65	78.04	55.60

—F. W. WOLL.

Humus, A. CASALI (*L'Humus. Milan: U. Hoepli, 1896, pp. 220*).—In his preface the author states that although the mineral theory of fertilizers of Liebig discredited the old humus theory the work of Pasteur and others demonstrated the unmistakable importance of humus in the soil. Nevertheless a somewhat exaggerated idea of the importance and value of the mineral fertilizers led to a neglect of humus, resulting in many cases in a serious deterioration of the soil. There has been a revival of interest in this subject which seemed to justify the preparation of a monograph on humus.

The present volume presents a very complete compilation of information on fermentations, properties, and decomposition of humus, with a discussion of the relations of humus to the fertilizing constituents of the soil and to mineral fertilizers, and Kramer's synoptical bacteriological tables of the fermentations of manure. To each of the four chapters there is appended a very full series of bibliographical notes, and at the end of the book is added an alphabetical index of some 220 authors, whose work is referred to in the text.

The book covers the subject in a thorough manner, and its excellent bibliographical features make it valuable to the student and investigator.

Considerations on the use of phosphatic fertilizers, P. P. DEHÉRAIN (*L'Engrais, 11 (1896), No. 7, p. 160*).

Chemical vs. barnyard manures, S. PEACOCK (*Amer. Fert., 4 (1896), No. 3, pp. 124, 125*).—The comparison in this article, as in previous articles, is based on the assumption that barnyard manure actually costs the farmer what he would have to pay for an equal amount of fertilizing matter in the form of commercial fertilizers.

A farm bone-meal factory, F. A. PUTNAM (*Rural New Yorker, 1896, Feb. 22, p. 114, fig. 1*).

Sewage farming in Madras and the suitability of the system for India, J. N. COOK (*Indian Med. Gaz., 30 (1895), No. 10, pp. 374-382*).

Burnt lime and marl, KARBE (*Fühling's landw. Ztg., 45 (1896), No. 5, pp. 167-169*).

Comparison of results with chemical and farmyard manures in New Jersey field trials, S. PEACOCK (*Amer. Fert., 4 (1896), No. 2, pp. 59-64*).

American phosphates in 1895, S. PEACOCK (*Jour. Soc. Chem. Ind., 15 (1896), No. 2, p. 99*).

Superphosphates from bones and from mineral phosphates, L. GRANDEAU (*Jour. Agr. Prat., 60 (1896), No. 10, pp. 346, 347*).—A brief note on proposed coöperative comparative tests by the Italian Federation of Agricultural Syndicates.

Sulphate of ammonia from coke and as a by-product of the iron industry (*Amer. Fert., 4 (1896), No. 2, pp. 79, 80*).

An experiment with Hensel's mineral fertilizer, W. MEYER (*Deut. landw. Presse, 23 (1896), No. 21, p. 179*).—An application of 1.5 marks worth of nitrate of soda produced better results than one of 22.5 to 25 marks worth of the Hensel fertilizer. The author states that an application of lime would have accomplished all that the Hensel mineral fertilizer did and at much less expense.

Fertilizer experiment with phosphate of potash on a fertile beet soil, VON SCHEIBE (*Deut. landw. Presse, 23 (1896), No. 20, p. 168*).—Nine plats were used in the trial on a good black soil with a loam subsoil. Phosphate of potash was used on beets alone and in combination with other fertilizing materials and proved an excellent fertilizer. The author concludes that as soon as it can be bought in the market at a moderate price it will be of great value in the production of beets.

Analyses of fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 34, pp. 7*).—Tabulated analyses of 83 samples of fertilizing materials, including madder refuse, cotton-seed meal, limekiln ashes, bituminous coal ashes, bones, nitrate of soda, sulphate of ammonia, muriate of potash, sulphate of potash, and mixed fertilizers.

FIELD CROPS.

Field experiments with barley, peas, wheat, oats, and beans, C. A. ZAVITZ (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 66-94*).

Synopsis.—Experiments with varieties of barley, peas, spring wheat, winter wheat, oats, beans, and mixed grains; dates for sowing grain; selection of seed of barley, peas, spring wheat, and oats; and drilling *vs.* broadcasting of small grains.

Forty varieties of 2-rowed and 6-rowed barley and 10 varieties of hulless barley were tested. Of the varieties grown for 6 years the

largest yields were made by Mandscheuri and Oderbrucker; of those grown for 5 years by Cape and Mensury. The hulless varieties in 1894 averaged only 36.5 bu. per acre against an average of 56.3 bu. for the other varieties. The 6-rowed varieties averaged about 10 bu. per acre more than the 2-rowed varieties, but the latter gave the heavier grain and the larger yield of straw. Of the hulless varieties Hungarian afforded the largest yield, 39.18 bu. per acre.

Forty-six varieties of peas grown in 1894 averaged 27.8 bu. per acre, the most productive varieties being Early Briton, White Wonder, Mummy, and Prussian Blue among those grown for 4 years, and Fall White, Marrowfat, and Canada Cluster among those grown for 3 years.

Among 9 varieties of spring wheat grown for 6 years Herison Bearded afforded the largest average yield, and Red Fern the largest yield among 21 varieties grown for 5 years.

The results with winter wheat were reported in Bulletin 97 of the Ontario Agricultural College (E. S. R., 6, p. 114).

Among 17 varieties of oats selected from 79 kinds grown in previous years the largest average yield for 6 years, 82.81 bu. per acre, was afforded by Joanette Black; the next largest yield by Siberian. The former had short straw, thin hulls, and heavy grain, and was found to be less susceptible to rust than most other varieties. Siberian is a white oat with spreading head, long and fairly strong straw, and heavy grain. When tested in 125 different localities in Ontario it afforded a larger average yield than any other variety, and is regarded by the author as having the best record among the 150 varieties which have been tested at the station. In 1894 varieties of oats having white grains exceeded in yield those having black grains by 5.7 bu. per acre and in weight per measured bushel by 3.5 lbs. Yellow oats gave the same average yield as black oats. Fifty-eight varieties with spreading panicles averaged 59 bu. per acre, while 25 varieties of side oats averaged only 48.7 bu. The former also afforded heavier grain, the side oats, however, producing slightly more straw.

Of 13 varieties of beans the largest average yields for 2 years were made by California Pea, Prolific Dwarf Tree, Small White Field, and Medium or Navy.

One variety of winter barley, though badly winterkilled, yielded 38.2 bu. per acre. Winter oats were completely winterkilled.

The average yield during a two years' test of various mixtures containing barley, wheat, oats, and peas in different combinations was 244.5 lbs. of grain per acre in excess of the average yields obtained by planting the same grains separately; during both years of the test the mixtures in every case afforded larger yields of straw than the grains sown alone.

Taking the average results for several years, the largest yields of barley and peas were obtained by sowing May 1, and of spring wheat and oats by sowing April 21, 22.

Experiments to determine the effect of sowing equal weights of large, small, shrunken, and cracked grains are reported, of which the results are given in the following table:

Yields from like weights of kernels of different sizes and conditions.

Amount of seed.	Size or condition of kernels.			
	Large.	Small.	Shrunken	Cracked.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
Barley, 80 lbs	46 87	45.73	35.83	35.00
Peas, 280 lbs	[1]19 32	[1]19.32	....	2.62
Spring wheat, 80 lbs	26.16	28.51	27.84	... .

[1] Average 2 years.

Another test is reported in which the same number of large, small, and shrunken kernels per plat was used instead of like weights. The amount of the large kernels was the same as in the preceding trial. The yields are given below:

Yields from like number of large, small, and shrunken kernels.

	Size or condition of kernels.		
	Large	Small	Shrunken.
	Bushels	*Bushels.*	*Bushels.*
Barley	46.87	37 50	36 27
Peas	18.83	17.17	.... .
Spring wheat	26 16	24 67	22 67
Oats	50 59	32 38	......

The figures of the last table indicate that the large kernels are more productive than the small kernels.

Weevil-eaten peas afforded only a fraction of the yield produced by an equal number of sound peas. The weevil-eaten seed had lost in weight 18 per cent.

A given number of double grains of oats afforded a smaller yield than a similar number of large or medium single grains, but a larger yield than a like number of single grains taken from double grains. When double grains were separated, the outer or large grains produced 34.4 bu. of oats per acre against 20 bu. afforded by an equal number of inner grains. Joanette Black oats lost in threshing a small percentage of their hulls, and these hulled oats yielded less than selected dark grains, but even more than selected grains of a light color.

Taking the average results for barley, peas, spring wheat, and oats, drilling afforded 0.7 bu. of grain per acre more than broadcasting.

Experiments with corn, rape, and miscellaneous crops, C. A. ZAVITZ (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 117–128*).—Among 110 varieties of corn grown for fodder, Cloud Early Yellow, Improved Leaming, Mammoth Cuban, and Salzer North Dakota are favorably mentioned. In rows 30, 36, or 42 in. apart single stalks were left 4, 8, and 12 in. apart in the drill. The largest yield of forage was

obtained when the distance between plants was 8 in., whatever the distance between the rows. Mammoth Southern Sweet was most productive when the drills were 42 in. apart; Wisconsin Earliest White dent yielded best in rows 36 in. apart, and Compton Early afforded the largest yield in rows 30 in. apart. Experiments to determine the relative values of kernels from different portions of the cob and of different sizes were made, but the differences in the yields were not large.

Of 16 varieties of millet tested the largest yields of green forage were made by Salzer Dakota, German, and Golden Wonder.

Oats, barley, wheat, and peas were sown alone and in various mixtures. In most cases the mixture afforded a larger yield of green forage than the separate constituents sown alone. The most productive mixture consisted of peas and oats. In experiments to determine the best proportions of peas and oats, the largest yield of green forage was obtained by sowing 1 bu. of oats and 3 bu. of peas per acre, but as the crop from this mixture was found liable to lodge, the author recommends the use of 1½ or 2 bu. of oats and 1 bu. of peas per acre.

The yield of green rape grown from large seeds was 33.98 tons per acre, from seeds of medium size 22.80, and from small seeds 11.78. The results of a test of sowing rape on a level, on ridges, and broadcast slightly favored sowing in drills without ridging. The yields of 7 varieties of sunflowers and 11 varieties of saccharine and non-saccharine sorghum are tabulated.

Crimson clover (*New Jersey Stas. Rpt. 1894, pp. 139–172*).—The greater part of this article is reproduced from Bulletin 100 of the station (E. S. R., 6, p. 204). A few additional experiments were conducted in 1894 to determine the hardiness of crimson clover for the central and northern portions of the State and to test different methods of seeding. In all localities the plant was hardy.

"Excellent stands were secured when the land was well prepared and the seed harrowed in, though in one case it was seeded July 20 and in the other September 4, 2½ months later. . . . Fair catches were secured when seeded in corn and cultivated in. One experiment was an entire failure, probably due quite as much to the fact that the seed was left on the surface as to the unfavorable conditions of weather."

Spring seeding was tested in several portions of the State, but resulted in failure whether the seed was sown alone or with oats.

The effect of lime on lupines, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 272–278*).—Lupines were grown in pots containing sandy soil alone and the same soil together with coarsely crushed chalk, coarsely crushed marble, fine chalk, or fine marble, and on marly soil with 14.4 per cent of carbonate of lime.

The largest yield of dry matter was made on the sandy soil without the addition of any form of lime; fine chalk and fine marble greatly reduced this yield. The plants that made the poorest growth, having received applications of lime in some form, contained the highest percentages of lime in the dry matter.

In another series of experiments there was added to a sandy soil used for the growth of lupines, gypsum, phosphate of lime, carbonate of magnesia, and chalk, in combination with different amounts of sulphate of potash. Again the plants in the untreated soil made the best growth. Gypsum was less injurious than any other form of lime, but the yield with gypsum was but little more than half as much as on the untreated soil. The conclusion of Schulz-Lupitz that the injurious effects of lime on lupines could be overcome by potash manures was not borne out by these experiments. In this series of experiments the highest content of lime in the dry substance of the plants (exclusive of the fruit) was found with those receiving gypsum, and with these plants also there was the highest percentage of sulphuric acid. The highest percentage of magnesia was found in the plants receiving carbonate of magnesia, the magnesia content in this case being more than double that obtained from the plants growing in any other pot. The highest percentage of phosphoric acid was obtained from the plants fertilized with phosphate of lime, the quantity here being 2 to 4 times as great as was obtained from the plants in any other pot.

In the author's opinion the hypothesis is no longer tenable that only those lupine plants with small percentages of lime make a good growth, for in his experiment the second highest lime content was found in the most vigorous plants, which grew on the untreated soil.

The need of lupines for potash, R. HEINRICH (*Zweiter Ber. landw. Vers. Stat. Rostock, 1894, pp. 278–281*).—A field was divided into 3 portions, and on one potash exhaustion was induced by omitting this element from the fertilizers used on the crops removed and supplying them with the other two important fertilizing ingredients. In a parallel manner on another portion phosphoric acid exhaustion was induced by omitting phosphoric acid from the fertilizers for the preceding crops. A third portion was made poor in nitrogen by a corresponding treatment.

After a number of years of such treatment lupines were grown on all 3 plats. The yield of green material on the nitrogen-exhausted plat was 40,022 kg. per hectare; on the plat exhausted of phosphoric acid, 30,255 kg., and on that deficient in potash only 6,748 kg.

The author's conclusions are that lupines under ordinary conditions need no nitrogenous fertilizers; that they thrive in soil having but a small content of phosphoric acid, but that they require a large quantity of potash in the soil.

In growing 4 crops of potatoes for the purpose of exhausting this soil preparatory to the experiment with lupines, the author found that the yield was least where nitrogenous fertilizers were withheld, indicating a special need of the potato plant for nitrogen. Potatoes grew well on the plat receiving no phosphatic manures for 9 years. After several years' cropping with potatoes there was indicated a need of potash for this crop on the plat receiving no potash.

Mangel-wurzels vs. fodder corn (*New Jersey Stas. Rpt. 1894, pp. 136–138*).—The mangel-wurzels were grown on a well-prepared tenth-

acre plat, receiving 1 ton of barnyard manure. The yield in October was at the rate of 28.4 tons per acre.

In the following table are compared the yields per acre of food constituents found in the mangel-wurzels, in the corn fodder (grown in conjunction with crimson clover on a plat in the rotation experiment), and in the corn fodder and crimson clover together:

Yield per acre of mangel-wurzels, corn fodder, and corn fodder and crimson clover.

	Green crop	Dry matter.	Crude fat	Crude fiber.	Crude protein	Crude ash.	Carbohydrates.
	Pounds.	*Pounds*	*Pounds*	*Pounds*	*Pounds.*	*Pounds*	*Pounds.*
Mangel wurzels	56,600	4,684	33.9	379.2	684.9	503.7	3,112.6
Corn fodder	20,000	6,130	152.2	1,487.7	468.9	243.8	3,780.2
Increase (+) or decrease (−)	+36,600	−1,446	−118.3	−1,105.5	+216.0	+259.9	−667.6
Corn fodder and crimson clover	32,200	8,656	237.6	2,108.1	909.3	439.0	4,962.9
Increase (+) or decrease (−) as compared with mangel wurzels	+24,400	−3,972	−203.7	−1,728.9	−214.4	−64.7	−1,850.3

It is stated that the total dry matter in the mangel-wurzels was nearly 25 per cent less than in the fodder corn. The corn fodder furnished nearly 5 times as much crude fat and 4 times as much crude fiber as the mangel-wurzels, besides one-fifth more carbohydrates. The mangels furnished more crude protein, over 50 per cent of which was in the form of amids.

The crop of clover and corn fodder is shown to contain nearly twice the amount of dry matter found in the mangels.

The relative proportions and amounts of the fertilizing constituents contained in the two crops are given.

"The crop of mangel-wurzels (though containing less than half as much dry matter) removed 50 per cent less of nitrogen, practically the same amount of phosphoric acid, and about 3 times as much potash as the crops of clover and corn."

Field experiments with potatoes, C. A. Zavitz (*Ontario Agl. College and Exptl. Farm Rpt. 1891, pp. 91–101*).—These consisted of experiments with varieties, depth of planting, amount of seed, distance between plants, fertilizers, dusting the seed pieces with plaster and lime, and use of eyes from different portions of the tuber. One hundred and seventy-eight varieties were tested, and the most productive were, among those grown for 5 years, Empire State; among those grown for 4 years, Tonhocks; among those grown for 3 years, Burbank Seedling; among those grown for 2 years, Pearl of Savoy, and among those grown for 1 year, Great Divide.

The average results for 3 years favored planting at a depth of 5 in., rather than 1, 3, or 7 in. deep.

"It was found that on the average the potatoes in the rows in which the tubers had been planted 1 in. below the surface were 2.3 in. deep; in the rows in which the tubers were placed 3 in. below the surface, 2.9 in.; in the rows in which the tubers were planted 5 in. below the surface, 4.1 in. deep; and in the rows in which the tubers were planted 7 in. below the surface, 6 in. deep.

"It was observed that a good many of the potatoes in the plats which were planted shallow, or near the surface, became badly sunburned, while in the plats where the tubers were planted deeper there was almost none of the crop which appeared in view."

Medium-sized whole potatoes afforded the largest average net yield for 3 years. The Rural trench system did not show any advantage over ordinary methods of planting. One-eye pieces gave a larger yield when planted 4 in. apart than when the distance was 8 or 12 in. Seed pieces cut 3 days before planting and dusted with lime or plaster afforded a yield considerably larger than seed pieces cut at the same time but not dusted. Single eyes from the middle portion of the tuber were slightly more productive than those from the stem end and from the seed end.

Experiments with roots, C. A. ZAVITZ (*Ontario Agl. College and Exptl. Farm Rpt. 1891, pp. 101–117*).

Synopsis.—Variety tests, distance experiments, and tests of large, medium, and small seed of ruta-bagas, turnips, mangel-wurzels, and carrots, and variety tests of sugar beets.

Among 30 varieties of ruta-bagas grown for 4 years Hartley Bronze Top was most productive. Varieties of turnips recommended for productiveness are Jersey Navet, Early American Purple Top, and White Egg, and for quality and earliness Imperial Green Globe. The most productive variety of mangel-wurzels was Evans Improved Mammoth Sawlog, followed by Carter Champion Yellow Intermediate. The most productive varieties of carrots were an Improved Half-Long White and an Improved Short White. The most productive carrots were white-fleshed and of such shape as to be easily removed from the ground. One of the easiest varieties to harvest was Guerande.

With ruta-bagas and mangel-wurzels, a distance of 8 in. between the plants afforded the largest average yield; with turnips, a distance of 4 in.; and with carrots, a distance of 2 in. With ruta-bagas, mangel-wurzels, and carrots the yield was larger when the distance between rows was 20 in. than when 26 or 32 in. With turnips, distances of 20 and 26 in. afforded practically the same yield and a larger crop than when the distance was 32 in.

The following table gives the yields of different root crops when large, medium, or small seed was planted:

Yield per acre of roots from seeds of different sizes.

Seed	Ruta bagas.	Turnips.	Mangel-wurzels.	Carrots.	Average of 4 classes of roots.
	Tons	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Large	20.85	32.85	28.88	34.05	29.16
Medium	20.03	24.00	27.53	33.98	26.39
Small	2.33	10.50	17.03	25.35	13.80

This table shows a decided gain from selecting large seed.

Analyses of turnips, ruta-bagas, and mangel-wurzels, A. E. SHUTTLEWORTH (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 35–38*).—Analyses are given of varieties of turnips, ruta-bagas, and mangel-wurzels, and of these roots grown at different distances in the row.

In rows about 27 in. apart roots were left unthinned, and thinned to 12 and 20 in. apart. With turnips, ruta-bagas, and mangel-wurzels the percentage of dry matter was greatest when the plants were not thinned. The roots not thinned contained in the dry matter less protein and fiber but more nitrogen-free extract than those thinned to 12 or 20 in.

The percentage of dry matter and the weight of roots were determined for unthinned plants and for those standing at distances of 4, 8, 12, 16, and 20 in. in the row. From the results obtained (apparently taking the yield for only one year) the author concludes that, considering both quantity and quality of dry matter, 8 in. between plants is the best distance for both turnips and mangel wurzels.

A study of the constituents of the nodes and internodes of the sugar cane, J. L. BEESON (*Louisiana Stas. Bul. 38, 2d ser., pp. 1311–1319*).—Analyses were made of the juice of nodes and internodes of canes with normal eyes, large eyes, and sprouted eyes. The juice of the nodes contained much less glucose, more solids-not-sugar, and more albuminoids than the juice of the internodes. However, in canes injured by cold the percentage of glucose in the juice of the nodes exceeded that in the juice of the internodes. "These facts can best be explained by the hypothesis . . . that the physiological function of the node in the cane is similar to that of the seeds in the case of flowering plants—to store food in the region of the eye for the use of the young plant before it has taken sufficient hold of the earth to draw sustenance from the atmosphere and soil." The juice from the nodes had a purity coëfficient of 81; that from the internodes a coëfficient of 89. "If a machine could be devised by which the nodes could be separated from the internodes so as to work the juices separately it would doubtless be profitable."

"Pedigreeing" cane, J. L. BEESON (*Louisiana Stas. Bul. 38, 2d ser., pp. 1356–1363*).—This chemical investigation was instituted to determine whether any change in the quality of sugar cane occurs as a result of continued planting of different portions of the stalk. For 8 years the top portion of the stalk was planted, the tops for seed being taken each year from canes also propagated by means of tops. Similarly for 8 years the middle portion of the stalk from canes propagated from middles was planted; and likewise the lower portion or butt of the stalk, taken from canes springing from planted butts, was used for seed. At the end of 8 years analyses were made of the 3 portions of the canes grown from (1) tops, (2) middles, and (3) butts. Under all conditions of propagation there were larger percentages of albuminoid nitrogen, amid nitrogen, and total ash in the tops than in the middles

and butts. "The presence of a larger amount of nitrogenous and mineral matter in the tops of the cane suggests the superiority of the tops, other things being equal, for planting, since these constituents are required as food for the young plant before it is old enough to win its living from the soil and atmosphere."

The ash of the tops and butts was analyzed and but little difference was found in composition; especially was there a close agreement in the percentages of potash, lime, and phosphoric acid. The juice from canes propagated by tops had a higher purity than when middles and butts were continuously planted.

Field tests indicated that tops used as seed germinated earlier in the spring than middles and butts, and chemical investigations indicated a somewhat greater maturity and a slightly higher sucrose content of canes grown from tops than from those propagated by middles or butts.

"One thing is shown beyond reasonable doubt, namely: That the cane has not deteriorated, in which case it will be greatly to the advantage of the planter to cut the tops away down to the joint that has cast its leaves for planting, and send the remainder of the stalk from the entire crop to the mill."

Effect of fertilizers upon sugar cane, J. L. BEESON (*Louisiana Stas. Bul. 38, 2d ser., pp. 1363-1371*).—Tabulated data give the average results for 5 years, and for 1894 relative to yield of cane and composition of juice produced on plats fertilized with different kinds and amounts of nitrogenous fertilizers, alone and in combination with minerals. There was some want of uniformity in the soil, so that results are not conclusive.

"While nitrogenous manures (alone) and mixed minerals (alone) have each greatly increased the tonnage over unmanured (the latter more so than the former), a combination of the two has given generally further increased results, and frequently with an increased sucrose and purity. . . .

"Sulphate of ammonia used in a double ration, mixed with mineral manures, has given the highest tonnage, followed closely by cotton-seed meal mixed in similar proportions."

The following table gives the percentages of total nitrogen existing as amids in canes differently manured:

Proportion of total nitrogen existing as amids in canes differently fertilized.

	Per cent.
Mixed minerals	20.66
Nitrogen (alone)	15.77
1 ration nitrogen and mixed minerals	22.23
2 rations nitrogen and mixed minerals	19.48

"In every instance where the nitrogenous fertilizer is used alone the percentage of amids is low, rising with the addition of mixed minerals and falling again with the double quantity of nitrogen combined with the mixed minerals." If it is assumed that a low percentage of amid nitrogen is an indication of a high degree of maturity, nitrogenous fertilizers in this experiment hastened rather than retarded maturity.

The yields and analyses of canes supplied with different kinds and amounts of potassic fertilizers are tabulated.

"The application of potassic fertilizers alone is without effect on the tonnage, sometimes apparently decreasing it, with increase of sucrose purity and albuminoid nitrogen." Further than this, the results for the most part were inconclusive.

Nitrate of soda as a top-dressing on timothy and rye (*New Jersey Stas. Rpt. 1894, pp. 116–120*).—In 2 localities in the State nitrate of soda was applied on acre plats of timothy at the rate of 100 lbs. per acre in the latter part of April. In each locality one plat received no fertilizer. The increased yield of hay was in one case 1,660 lbs. and in the other 620 lbs. per acre; with hay at $10 per ton there was a profit in both cases. The largest increase in yield was obtained on the more productive soil.

A similar experiment was conducted in 3 localities in the State with rye. With 100 lbs. of nitrate of soda per acre the increased yields over the unfertilized plats were in grain 21.1, 37.4, and 27.1 per cent; in straw 36.7, 37, and 33.5 per cent. With rye at 45 cts. per bushel and straw at $8 per ton the use of nitrate of soda resulted in a small profit in every case.

Selection of seed wheat, F. DESPREZ (*Jour. Agr. Prat., 59 (1895), No. 46, pp. 691–698*).—Large kernels were selected from a crop grown from large seeds for several years, and likewise small seeds were selected from a crop grown year after year from small seeds. Five varieties were used in this experiment. The average results for 1893, 1894, and 1895 are tabulated, and these give the average weight of the individual seeds and the yield of grain and straw per hectare for the crop from large seed and from small seed.

The average difference in the yield of grain from the use of large seed grown from an ancestry of the same kind was 1,067 to 1,828 kg. of wheat per hectare, according to the variety. The use of large seed gave a crop with kernels larger than those grown from small seed. It was also noted that the large grains germinated better than the small grains, and grew more vigorously, and that the crop from large grains matured better than that from small grains.

In order to determine whether or not it was possible to change the ripening season of a given variety of wheat the author selected the ears which first flowered, and from the same stool those which flowered 6 to 8 days later. By continuing this process for 4 years he succeeded in accelerating or retarding the ripening period of a variety from 4 to 6 days.

Investigations to determine the relative value for seed purposes of grains from the center and from the extremities of the ear afforded inconclusive results as to the yield of straw and grain; however, the specific characters of the variety were best transmitted when the seed grown was chosen from the middle of the ear.

The varieties having the spikelets most closely crowded together were more productive than those in which the arrangement of spikelets was loose.

A study of a rotation for dairy farms (*New Jersey Stas. Rpt. 1894, pp. 132–136*).—This is a continuation of work published in the Annual Report of the station for 1893 (E. S. R., 6, p. 807). The rotation is as follows: First year, field corn, seeded to crimson clover; second year, crimson clover, followed by fodder corn, and the land seeded to rye after corn; third year, rye fodder, followed by oats and peas, seeded to red clover and timothy; fourth year, hay.

The yield of the crimson clover cut for hay was at the rate of 12.4 tons of green material per acre, though the amount gathered was only 6.1 tons. The succeeding crop of corn fodder yielded 4.05 tons per acre, air dry. On one plat the crimson clover was turned under for manure, and the crop of corn fodder grown after it yielded 25,800 pounds per acre, green weight.

Tabulated data of the total yield per acre of food constituents in the crimson clover and the succeeding corn fodder are given and compared with the yield of constituents in the green-manured corn fodder as follows:

Yield per acre of crimson clover and corn fodder.

	Total dry matter	Crude fat	Crude fiber	Crude protein	Crude ash	Carbohydrates
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds.*	*Pounds*
Crimson clover and corn fodder	8,656	237.6	2,108.1	909.1	339.0	4,962.9
Corn fodder (after crimson clover plowed under)	7,039	180.1	1,510.1	615.3	237.9	4,495.4
Difference .. .	.	57.5	598.0	294.0	101.1	467.5

"A study of these figures shows not only that the total amount of food obtained per acre was considerably greater when the clover was used as forage, but that it was much better than that obtained where the clover was turned under, though the corn crop was largely increased, both in yield and quality."

The increased yield of dry matter with the 2 crops was 23 per cent, of fat 32 per cent, and of protein 48 per cent.

Chrysopogon parviflorus, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 6 (1895), No. 11, pp. 733, 734, pl. 1*).—Notes are given of this grass, which the author thinks worthy of extended trial.

The effect of salt water on cultivated plants, F. WOHLTMANN (*Fühling's landw. Ztg., 45 (1896), No 15, pp. 477–479*).—If the amount of salt was from 5 to 10 gm. per liter the growth of the better grasses and leguminous plants was dwarfed and the yield reduced, and the young grass springing from seed dropped by the growing plants killed. If year by year the meadows are flooded with water containing ½ to 1 gm. of salt per liter the stand of grass continually grows poorer.

The influence of the weight of seed upon the grain production of yellow and blue lupines, common vetch, and buckwheat, H. EBELING (*Inaug. Diss. Leipzig, 1895, pp. 65; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 7, pp. 537–539*).

The cultivation of maize, or Indian corn, J. L. THOMPSON (*Agl. Gaz. N. S. Wales, 6 (1896), No. 12, pp. 871, 872, figs. 12*).—A popular, illustrated article treating of the origin, details of culture, insect enemies, and varieties of Indian corn.

Care and manuring of meadows (*Ztschr. landw. Ver. Rheinpreussen, 13 (1896), No. 4, pp. 29, 30*).

The tillage of meadows, STRECKER (*Deut. landw. Presse, 23 (1896), No. 19, p. 158, figs. 3*).—Some observations are given on the importance of proper treatment of meadows, and an illustrated description is given of an implement designed to cut the sod in strips, dig up the subsoil beneath, and replace the strip of sod, all at one operation.

Studies on the distribution of plants in meadows, R. BRAUNGART (*Fühling's landw. Ztg., 44 (1895), No. 21, pp. 760–768; 45 (1896) Nos. 1, pp. 15–21; 3, pp. 96–103; 5, pp. 150–155*).

Studies of the Norway pastures and meadows, B. HANSTEEN (*Biol. Centbl., 1896, No. 3*).

The increase of the yield of potatoes as the space allotted to each plant increases, N. WESTERMEIER (*Deut. landw. Presse, 22 (1895), No. 104, p. 945; 23 (1896), No. 1, p. 3*).—The author states that for the humus loam of that region 2,500 sq. cm. for each plant gives the highest yield.

Nitrate and superphosphate in the culture of the potato, MAIZIÈRES (*L'Engrais, 11 (1896), No. 11, pp. 252–254*).

Experiments with fertilizers on potatoes (*New Jersey Stas. Rpt. 1894, pp. 115, 116*).—This experiment, occupying 16 plats, was vitiated by drought, so that the increased yield due to fertilizers was in no case sufficient to pay the cost of application.

Annual report of the experimental and potato culture station at Neuhaus near Paupitzsch (Delitzsch) for 1895, F. SCHIRMER (*Fühling's landw. Ztg., 45 (1896), No. 3, pp. 105–107*).—A list of 30 varieties is given, with the yield and starch content.

The groundnut, or earth nut (Arachis hypogæa), G. WATT (*Indian Agr., 21 (1896), Nos. 1, pp. 15–20; 2, pp. 43–49*).—An exhaustive article giving the bibliography and history of the introduction of the peanut, and treating of its value as an agricultural crop, its oil and oil cake, adulteration of the oil, its use in the dyeing and tanning industries, the medicinal value and uses of the oil, the importance of the groundnut (peanut) as an article of human food and fodder for cattle, the minor uses of the the plant (manure, fuel, etc.), the chemistry of the groundnut and of its oil and oil cake, and the Indian and foreign trade in the various products of the plant.

The groundnut, or earth nut (Arachis hypogæa), a review of recent information, G. WATT (*Agl. Ledger, Vegetable Product Ser., No. 8, 1895, No. 15, pp. 1–46, fig. 1*).—The author gives a brief description of this plant and a detailed account of its cultivation in India. Tables are given showing statistics of the average yield in India and the exports to other countries. It appears that the largest quantity of peanuts from India is exported to France, Egypt, and Belgium. It is stated that the Indian plant attracts large numbers of red ants, which in the gardens of Bengal seem regularly to soften and pulverize the soil as if to facilitate the growth of the pods. The ants do not seem, however, to injure the plant in any way.—T. HOLM.

Injurious effect of nitrate of soda on winter rye, M. WEYDEMANN (*Deut. landw. Presse, 23 (1896), No. 17, pp. 140, 141*).

On the loss of sugar in beets during storage, F. STROHMER (*Oesterr. ungar. Ztschr. Zuckerind. und Landw., 1895, p. 685; abs. in Bot. Centbl. Beiheft, 5 (1895), No. 7, pp. 542–544*).

The influence of heat, rain, and soil moisture on the weight and sugar content of sugar beets during the season of 1895, L. KUNTZE (*Ztschr. Ver. Rübenz. Ind., 1896, Feb., pp. 87–92, fig. 1*).

A study of hairy vetch, G. LECHARTIER (*Ann. Sci. Agron., ser. 2 (1896), 1, No. 1, pp. 102–120*).

The composition of straw of different kinds and of clover hay at Postelberg in an abnormally dry and wet year, J. HANAMANN (*Jour. Landw., 43 (1895), No. 4, pp. 337-348*).

Catch crops on light soils, SCHULTZ-LUPITZ (*Zwischenfruchtbau auf leichten Boden. Berlin: 1895, figs. 14; abs. in Deut. landw. Presse, 23 (1896), No. 20, p. 171*).—As the most suitable, deep-rooted, nitrogen-collecting plants for catch crops, the author mentions among the Leguminosæ not requiring lime, the blue, white, and yellow lupine, and serradella; among the lime-loving leguminous plants, yellow clover, Swedish clover, and the flat pea. The ordinary field pea is a collector of nitrogen, but is not a deep rooted plant. In Lupitz the turning to account of catch crops has been better accomplished by plowing under than by feeding.

The improvement of cultivated crops, K. HANSEN (*Tidskr. Landökon., 14 (1895), pp. 413-440, 706-715*).

Tests of the cultural value of different sorts of grain, F. HEINE and N. WESTERMEIER (*Deut. landw. Presse, 23 (1896), Nos. 18, pp. 152, 153; 19, p. 159*).

The improvement of grain, a resource of great importance for the profitableness of grain culture, LIEBSCHER (*Deut. landw. Presse, 23 (1896), No. 18, p. 152*).

Coöperative seed tests, A. J. BONDURANT (*Alabama Sta. Bul. 65, pp. 159-181*).—Reports of 23 farmers throughout the State on coöperative tests of crops grown from seed sent out by this Department.

Silage, K. KRISTENSEN (*Tidskr. Landökon., 14 (1895), pp. 299-353*).—A résumé of investigations made in the different countries, with descriptions of the various systems of stack silage applied (Lindenhof, Blunt, Dolberg, Johnson, Ramstedt).

Report of the agriculturist, J. F. HICKMAN (*Ohio Sta. Rpt. 1894, pp. XXII-XXV*).—Brief mention is made of experiments in progress with forage crops, of fertilizer experiments, feeding experiments, a test of breeds of dairy cows and sheep, farm improvement, and farm products grown in 1894.

Agriculture in the southern Shan States, A. H. HILDERBRAND (*Indian Agr., 21 (1896), No. 2, pp. 49-51*).—An account of experiments in growing European grains, vegetables, and fruits in India.

HORTICULTURE.

Experiments with fertilizers upon sweet potatoes (*New Jersey Stas. Rpt. 1894, pp. 102-111*).—These are in continuation of experiments carried on in 1892 and 1893 to determine if profitable crops can be raised with chemical manures, to compare the relative value of nitrogen in the forms of nitrate of soda and of dried blood, and to study the comparative effects of different quantities of New York horse manure alone and in combination with chemical manures.

The experiments were carried out on two different types of soils, one a sandy loam with clayey subsoil, and the other a sandy loam with sandy and gravelly subsoil. Dry hot weather reduced the yield on the latter soil. On the first soil the variety Up River was employed and on the second Yellow Nansemond.

Tables are given showing the number of plats, the amount and kind of fertilizer used on each, and the yield per acre in bushels. The adjoined table gives a summary of the results.

Yield of potatoes with different fertilizers.

Group.		Soil No. 1.				Soil No. 2.			
		Total.	Large	Small.	Large.	Total.	Large	Small	Large.
		Bu.	*Bu.*	*Bu.*	*Per ct*	*Bu*	*Bu.*	*Bu*	*Per ct.*
1	Unfertilized	182.3	130 8	51.5	71.7	51.4	28.2	23.2	54 8
2	Minerals alone	260 6	204 1	56.5	78 3	118.4	81.5	36.9	68 8
3	Minerals and nitrate	243.6	181.1	62.5	74.3	115.4	77.3	38.1	67.0
4	Minerals and dried blood	252.1	189.4	62 7	75 1	95.7	64.2	31 5	67 1
5	New York horse manure	277.8	222.4	55 4	80 1	167.4	126 9	40.5	75.8
6	New York horse manure and chemical manures	270 8	218 6	52.2	80 7	172.2	130 6	41 6	75.8

Tables are given showing the financial results from all of the plats. The conclusions reached were that not only could sweet potatoes be raised by chemical manures alone, but that the increased yield was sufficient to pay a considerable profit. Where horse manure alone was used, the profit from the crop was not sufficient to pay the cost of the manure. The results from the use of the various forms of nitrogen are conflicting in different years, but with the odds apparently slightly in favor of the dried blood. The addition of nitrogen, however, was followed by a financial loss, as, though the yield of potatoes was increased, the addition was not sufficient to pay the cost of the fertilizers. As a consequence, the use of fertilizers rich in nitrogen is strongly questioned. Combinations of chemical and horse manures show results slightly in favor of the combination, where small quantities were used. Where larger quantities were applied, the added expense was not made up by the sale of the crop. It is stated that further experiments are needed to determine the kind and amounts of manures best adapted for the crop.

Experiments with fertilizers upon tomatoes (*New Jersey Stas. Rpt. 1894, pp. 97-102*).—This is in continuation of a series of like experiments carried on by the station. The results for the previous years have indicated that when land has been heavily fertilized for a previous crop an application of from 200 to 300 lbs. of nitrate of soda per acre, half at the time of setting the plants and half 3 or 4 weeks later, gives good results; whereas, if the land is light and not heavily manured, other chemical fertilizers must be combined with the nitrate of soda so as to make a complete manure and applied before setting the plants.

The experiments in 1894 were carried out on 2 types of soils—one a sandy loam with clay subsoil, well manured, and the other a light sandier soil with very slight previous application of fertilizers. On each soil 3 plats were made use of, one unfertilized, another fertilized with nitrate of soda, and a third with nitrate of soda, boneblack superphosphate, and muriate of potash. The experiment on the lighter soil was interfered with by storms and unfavorable weather, but sufficient results were obtained to verify the conclusions of the previous years. Tabulated data are given of the yield and selling price of the tomatoes. On the heavier soil the plat fertilized with a complete fertilizer produced the largest and most perfect fruit.

Vegetables, R. H. PRICE, H. H. HARRINGTON, and H. NESS (*Texas Sta. Bul. 36, pp. 609–618, figs. 20*).

Synopsis.—This bulletin comprises short articles by the several authors, embodying cultural notes and variety tests of sweet potatoes, onions, melons, celery, beans, cabbage, cauliflower, and tomatoes.

Sweet potatoes (pp. 609–628).—This is a continuation of the work recorded in Bulletin 28 of the station (E. S. R., 5, p. 872). The work in sweet potatoes was much enlarged in 1894, 50 varieties and 3 synonyms being included in the investigations. The soil employed was a dark, sandy compact clay of medium fertility and ridge culture was used, the ridges being 4 in. high and 4 ft. apart. The plants were set 14 in. apart, each variety being given 50 ft. of row. An elaborate table is given showing the character of the baked flesh, season, yield, and quality of the 50 named varieties. The variety General Grant made the largest yield per acre, 618 bu., for 1 year, and Shanghai the largest average for 2 years.

Experiments were made with planting different sized sweet potatoes, with the result that both the total yield and the number of large potatoes were greater when small potatoes were planted than when large roots were used. Tabulated data on this test with the varieties Shanghai and Vineless are given. It was found that the heavy vine varieties grew quickly from vine cuttings, producing better crops than did the small vine varieties propagated by the same method.

Descriptive notes are given on 22 varieties not mentioned in Bulletin 28 of the station. Historical and descriptive notes are given on the variety Vineless, which was first found growing among some hills of the Yellow Yam variety. Of the 5 strains of the Vineless type only one is recommended by the writer. Illustrations are given showing the arrangement of the leaf stalks in the Vineless variety.

Experiments with fertilizers have been carried on, and though absolute conclusions are not yet drawn, the results so far reached favor boneblack 300 lbs. and sulphate of potash 200 lbs. per acre for sweet potatoes on the soil of the station.

Notes and tabulated data are given on a test of 8 varieties in Galveston County, in which Vineless gave the heaviest yield, but the test was interfered with by drought, followed by excessive rains.

Directions are given for transplanting sweet-potato plants and several forms of apparatus are figured. The subject of harvesting and storing is also treated, and an illustration given of a form of storehouse recommended.

The following fungus diseases are described and remedies suggested: Soft rot (*Rhizopus nigricans*), black rot (*Ceratocystis fimbriata*), stem rot (*Nectria ipomϾ*), and sweet potato scurf (*Monilochætes infuscans*). Dipping plants in a mixture of London purple, lime, and water is recommended before planting them out, and an illustration is given of the new pest, the root borer (*Cylas formicarius*), which it is believed may prove of considerable injury.

A list is given classifying the different varieties according to the shape of the leaves and the color of the skin.

Water and sugar in sweet potatoes as influenced by keeping (pp. 628, 629).—Notes and analytical data on 16 varieties of sweet potatoes analyzed in November, December, and March. As was to be expected, the water decreased as the winter advanced, while the amount of total sugar increased. The amount of invert sugar increased also, though not so uniformly as the total sugar. The highest amount of total sugar at the last analysis was found in Vineless (Early Bunch Yam). As this potato also was one of those losing the most water, it is believed to be the best for table use when a dry potato with a large amount of sugar is wanted. The next best answering the purpose is Pumpkin Yam.

Varieties of onions (pp. 629–632).—This consists of tabulated data of 58 varieties of onions, the variety El Paso producing the greatest yield, while Red Bermuda was the earliest variety. In a keeping test the Prize Taker proved the best. Detailed notes are given on the cultural methods employed. The transplanting method, or "new culture," practiced successfully in the North, was tried and is believed to be not advantageous in Texas on account of the transplanting checking the growth of the young plants, while the winters are rarely severe enough to kill onions seeded in the field. The plants were placed 15 in. apart in a shallow furrow and the earth thrown upon them by means of a Planet Jr. plow.

Muskmelons and cantaloupes, varieties and culture (pp. 632–636).—Descriptive notes are given for 39 varieties of melons which were planted according to 2 methods, in hills and in ridges along which the seed was drilled. By the latter method the melons ripened earlier and were more abundant. Several fertilizers were used, singly and in combination, the best results being obtained from 300 lbs. of boneblack and 200 lbs. of sulphate of potash per acre. To avoid danger from frost the melon seeds were planted in 2 inch flowerpots or in small tin cans in hotbeds and afterwards transplanted to the field. Threatened attacks by the striped beetle (*Diabrotica vittata*) were avoided by spraying with Bordeaux mixture and London purple.

Celery (pp. 637, 638).—Brief cultural and descriptive notes on 11 varieties of celery. It was attempted to make part of the crop self-blanching by growing the plants close together, but the method did not succeed, while the usual plan of blanching by means of mounding with earth was successful.

Varieties of beans (pp. 639, 640).—Cultural notes and tabulated data on 33 varieties of bush and pole beans and descriptive notes on 6 varieties of Lima beans.

Varieties of cabbage, cauliflower, and tomatoes (pp. 641–648).—Cultural notes and tabulated data are given for 29 varieties of cabbage, the Jersey Wakefield, Tait Pilot, Flat Dutch, and Henderson Succession being considered most worthy of recommendation. Half of the plants

were irrigated with a decided effect in the earliness and size of the heads produced.

Cauliflowers proved a failure as a spring crop, although they were more satisfactory in the fall.

Cultural notes and tabulated data are given on 50 varieties of tomato, Atlantic Prize, Ignotum, Livingston Favorite, Livingston Stone, and Ponderosa being considered as specially desirable. Pruning was practiced on the variety Dwarf Champion with the beneficial result of increasing the productiveness and invigorating the plants after they had been weakened by drought and lack of cultivation. Experiments with growing tomatoes from cuttings were successful, shoots 6 in. long being planted one-half their length in a sandy loam soil early in August and the resulting plants coming into bearing in November.

Field experiments with fertilizers upon peach trees (*New Jersey Stas. Rpt. 1891, pp. 121–127*).—This is a report upon 2 continuous experiments with the application of different fertilizers to peach trees, one experiment having been continued for 8 years. Various combinations of fertilizers were employed and tables are given showing the composition of the different fertilizers and the yield and value of the crop per acre for the 8 years. The destruction of the orchard this year by storms necessitates the discontinuance of the experiment. The conclusions reached are that it is advantageous to manure peach orchards on lands of medium fertility; that manuring extends the profitable bearing period of the trees; that complete fertilizers are preferable to single elements or combinations of 2 elements; and that chemical fertilizers are more profitable than barnyard manure. Of the single elements potash has proved the most valuable.

The second experiment is designed to test the effect of an excess of plant-food elements on the health and productiveness of peach trees, and also the effect of nitrogen and phosphoric acid from different sources. The experiment has been in course for 5 years, and a table is given summing up the results for that period. The effect of fertilizers is not particularly noticeable on the trees, although a deeper color and stronger growth of foliage is apparent on the fertilized plats. The most decided increase in yield has been obtained by the use of nitrogen and phosphoric acid applied in the form of organic matter by means of ground bone and ground fish.

Report of the horticulturist, W. J. GREEN (*Ohio Sta. Rpt. 1891, pp. XXVI–XXVIII*).—This contains a progress report on the investigations being carried on in the greenhouses, especially in the direction of subirrigation, with regard to lettuce, radishes, and tomatoes. It has been found that watering by subirrigation is cheaper and more efficient, the soil remains looser, and the plants grow better than when surface watering is done. Mention is made of preparations to carry on extensive rotation experiments with potatoes, wheat, and clover, and the general routine work of the department is briefly dwelt upon.

Report of the horticulturist, W. L. HUTT (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 47-56, pls. 2*).—A general report on the work of the year in the department, the teaching, management of the department, and work at the fruit experiment stations being each reported upon. Special attention is being paid to greenhouse work, and 5 varieties of English forcing cucumbers were successfully grown in one of the houses. A collection of economic plants is in process of arrangement. Plans are being made to locate 10 fruit experiment stations in different portions of Ontario to test the value of different fruits in different sections of the country.

Experiment with fertilizers on asparagus (*New Jersey Stas. Rpt. 1894, p. 128*).—This announces the beginning of an experiment to ascertain if asparagus can be profitably grown with commercial fertilizers alone. The soil employed is a well-drained sandy loam, planted with the variety Barr Mammoth.

Forcing asparagus, N. SCHNEIDER (*Rev. Hort., 68 (1896), No. 2, pp. 44-47*).—Brief notes on greenhouse culture.

Forcing beans in a hotbed, N. SCHNEIDER (*Rev. Hort., 68 (1896), No. 3, pp. 68-71*).—Brief notes on culture under glass.

Forcing of legumes, N. SCHNEIDER (*Rev. Hort., 68 (1896), No. 1, pp. 20-24*).

A new Japanese vegetable, E. ANDRÉ (*Rev. Hort., 68 (1896), No. 3, pp. 55, 56, fig. 1*).—Illustrated description of *Aralia cordata*.

Lettuce under glass, F. E. CARR (*Garden and Forest, 9 (1896), No. 419, p. 98*).—Brief note on methods used.

Vegetable marrow, J. C. TALLACK (*Garden, 49 (1896), No. 1265, p. 115, fig. 1*).—Cultural notes on this cucurbit, which is recommended for gardens.

Crabapples of American origin, C. GROSDEMANGE (*Rev. Hort., 68 (1896), No. 3, pp. 63-66, figs. 5*).—An annotated list of 12 varieties, with cultural remarks.

Chemical analyses of the fresh and seeded fruit of the Indian fig (Cactus opuntia), and of the biennial articulations of the same plant, G. M. LIMA (*Staz. Sper. Agr. Ital., 28 (1895), No. 12, pp. 807-816*).

The Italian prune (*Canadian Hort., 19 (1896), No. 2, pp. 37, 38, pl. 1, fig. 1*).—Brief note on the growing of prunes, especially the variety Fellemburg, in Ontario.

Strawberry culture, T. B. TERRY (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 301-306*).—A popular paper on the subject, with special reference to cultural points, clean culture being especially urged.

Concerning our berries, R. VON FISCHER-BENZON (*Bot. Centbl., 64 (1895), Nos. 10, pp. 321-328; 11, pp. 369-376; 12, pp. 401-411*).

Pruning and trellising grapes (*Canadian Hort., 19 (1896), No. 2, pp. 49, 50, figs. 3*).—General popular directions.

On the renewal of vineyards by American hybrids, P. CASTEL (*Prog. Agr. et Vit., 25 (1896), No. 3, pp. 68-74*).

Pinching vines, A. LEFEBVRE (*Rev. Hort., 68 (1896), No. 3, pp. 66, 67*).—Brief remarks and directions for this kind of pruning.

Fruit preserving in the Crimea (*Gard. Chron., 19 (1896), No. 477, p. 198*).—Brief statistical notes on the status of the industry in the Crimea.

The Dauphin chestnut, M. L. DOCK (*Garden and Forest, 9 (1896), No. 42, pp. 114-116, pl. 1*).—Illustrated notes are given of a remarkably large chestnut tree at Dauphin, Pennsylvania.

Chrysanthemums, A. S. SWANSON (*Amer. Florist, 11 (1896), No. 404, pp. 782-784*).—Preferred methods of growing these flowers to obtain large blooms.

Chrysanthemums from seed (*Garden, 49 (1896), No. 1266, p. 129*).—Brief notes on the originating of new varieties.

Grafting chrysanthemums, C. GROSDEMANGE (*Rev. Hort.*, *67 (1895), No. 24, pp. 576, 577*).—Notes on experiments in this line, with directions for performing the operation.

How to succeed with chrysanthemums (*Canadian Hort.*, *19 (1896), No. 2, pp. 57–60, figs. 2*).—Popular cultural directions, watering, manuring, and disbudding being chiefly discussed.

The gladiolus, H. H. GROFF (*Canadian Hort.*, *19 (1896), No. 2, pp. 62, 63, fig. 1*).—Botanical and cultural remarks.

Hepaticas, S. ARNOTT (*Jour. Hort.*, *1896, No. 2473, p. 104*).—Notes on the history, culture, and varieties of these flowers.

Orchids, their culture and management, W. WATSON and W. BEAN (*London: U. Gill, pp. 554, 2d ed.*).

Ancient roses (*Gard. Chron.*, *19 (1896), No. 478, pp. 229, 230*).—A popular article on rose growing by the Romans.

Grafting tea and other roses (*Garden*, *49 (1896), No. 1266, pp. 143, 144*).—Descriptions of methods.

Over-ripened wood in roses (*Garden*, *49 (1896), No. 1266, p. 143*).—Half-ripened shoots produce the truest blossoms.

Willows vs. bamboos, F. W. BURBIDGE (*Garden*, *49 (1896), No. 1266, pp. 141, 142*).—Notes on the two for ornamental gardening, the willows being preferred as more hardy.

Warming tanks for the Victoria regia, W. TRICKER (*Garden and Forest*, *9 (1896), No. 418, p. 86*).—Directions for heating the water in the tanks where this plant is grown.

Kitchen garden planting, FABLE (*Amer. Gard.*, *17 (1896), No. 61, p. 117*).—A tabulated list of nearly 50 vegetables, showing in what month and how to plant to secure a succession of crops.

The composition and application of horticultural products, J. SEBELIEN (*Norsk. Havetidende*, *11 (1895), pp. 39–52, 55–59, 78–82*).

Horticulture in connection with agriculture, E. LICK (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 309–312*).—A popular article advocating the pursuit of agriculture and horticulture together, the writer believing that the two branches can be profitably combined. Special remarks are made on the care of orchards.

Water-pipe boilers, L. WIGHT (*Florists' Exchange*, *8 (1896), No. 9, p. 188*).—Directions for the home construction of a heating system for greenhouses.

Bulb farming for the Southwest, L. S. LAMANCE (*Garden and Forest*, *9 (1896), No. 418, p. 87*).—Recommends the South Ozark region of Missouri for the raising of flower bulbs.

Flower-seed table (*Amer. Gard.*, *17 (1896), No. 62, p. 133*).—This is a tabulated guide to the proper time and methods for the sowing of various flower seeds in the garden or greenhouse. Fifty-six different flowers are included.

SEEDS—WEEDS.

Impurities in clover seed, J. H. PANTON (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 11–16, figs. 10*).—The author reports upon 60 samples of alsike and red clover seed examined during the year. Of the 27 samples of alsike the percentage of vitality varied from 49 to 97, and for the red clover seed from 79 to 98 per cent. The percentage of weed seed varied in the different samples from 0.01 to 22.7 per cent. All specimens were found true to name.

"Of the 60 samples examined, 53 contained grass seed; 27, seeds of white cockle (*Lychnis vespertina*); 32, sorrel (*Rumex acetosella*); 8,

campion (*Silene inflata*); 17, chicory (*Cichorium intybus*); 9, rib grass (*Plantago lanceolata*); 4, ragweed (*Ambrosia artemisiæfolia*); 3, smartweed (*Polygonum pennsylvanicum*); 5, chess (*Bromus secalinus*); 5, bindweed (*Polygonum convolvulus*)."

Figures are given representing the natural and magnified forms of some of the more common weed seeds, as follows: Rib grass, sorrel, oxeye daisy, chicory, ragweed, bindweed, black bindweed, white cockle, bladder campion, and chess.

Poisonous plants of New Jersey, B. D. HALSTED (*New Jersey Stas. Rpt. 1894, pp. 401–419, figs. 6*).—A preliminary report is given of the known poisonous plants growing within the State. Numerous instances are cited of poisoning of men and animals being traced to various plants, and descriptions are given of a few of the more common plants that are poisonous to the touch and of those which are poisonous when eaten.

A list is given of the plants grown in the State concerning which complaints have been made. More than 75 species are enumerated whose effect varies from slight irritation to the causing of death. In addition to those enumerated in the list mentioned, reference is made to poisonous fungi, conspicuous among which are the ergots, specimens of which from 10 different grasses are figured.

The Russian thistle and thistle-like plants, B. D. HALSTED (*New Jersey Stas. Rpt. 1894, pp. 301–319, figs. 12*).—Illustrated notes are given on the Russian thistle (*Salsola kali tragus*), horse nettle (*Solanum carolinense*), buffalo bur (*S. rostratum*), spiny cocklebur (*Xanthium spinosum*), spiny sow thistle (*Sonchus asper*), teasle (*Dipsacus sylvestris*), spiny amaranth (*Amarantus spinosus*), sand bur (*Cenchrus tribuloides*), Canada thistle (*Cnicus arvensis*), and pasture thistle (*C. lanceolatus*). Mention is made of a disease of the Canada thistle due to a rust, *Puccinia suaveolens*. During the year a quantity of diseased material was distributed to correspondents with the hope that the disease might be caused to spread. Further investigations on this subject are expected to be carried on.

Dispersal of seeds by birds, H. N. RIDLEY (*Nat. Sci., 8 (1896), No. 49, pp. 186–199*).

New germinating apparatus, C. ASCHMAN (*Chem. Ztg., 20 (1896), No. 7, p. 54, fig. 1*).

Report of Boraas Seed-Control Station for 1894, A. W. ESSÉN (*Boraas (Sweden): 1895, pp. 8*).

Report of Christiana Seed-Control Station for 1894, B. LARSEN (*Beretn. Kgl. Selsk. Norges Vel. 1894, pp. 116–133*).—A summary of all seed analyses made during the past 8 years is given, in addition to the usual report of the seed-control work performed during the year. The main data of the summary are given in tabular form, only averages of 10 or more samples being included.—F. W. WOLL.

Report of Christianstad Seed-Control Station for 1893–'94, L. J. WAHLSTEDT (*Christianstad (Sweden): 1895, pp. 8*).

Report of Gefleborg County Seed-Control Station for 1894, A. WESTMAN (*Gefle (Sweden): 1895, pp. 6*).

Report of Göthenborg and Bohus County Seed-Control Station for 1893–'94, J. E. ALÉN (*Gothenburg (Sweden): 1895, pp. 18*).

Report of Hernösand Seed-Control Station for 1894, C. G. STROKIRK (*Hernösand (Sweden): 1895, pp. 14*).

Report of Ope Seed-Control Station for 1894 (*Ope (Sweden): 1895, pp. 7*).

Report of Lund Seed-Control Station for 1894, B. JÖNSSON (*Lund (Sweden): 1895, pp. 14*).

Report of Skara Chemical and Seed-Control Station for 1894, O. NYLANDER (*Skara (Sweden): 1895, pp. 18*).

Report of Stockholm County Seed-Control Station for 1894, O. STJERNQUIST (*Stockholm (Sweden): 1895, pp. 8*).

Report of Wärmland County Seed-Control Station in Molkom for 1894, J. A. ANDERSSON (*Karlstad (Sweden): 1895, pp. 18*).

Noxious weeds along thoroughfares and their destruction, A. D. SELBY (*Ohio Sta. Bul. 59, pp. 5*).—The text of the State law relative to the destruction of weeds is given, and inquiry is made concerning the appearance and spread of troublesome weeds along roadsides and elsewhere.

Weeds of New South Wales, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 811–813*).—Notes are given upon the occurrence and methods of eradication of catch fly (*Silene gallica*), stinkwort (*Inula graveolens*), and wild melon (*Cucumis myriocarpus*).

DISEASES OF PLANTS.

Report of the botanist, B. D. HALSTED (*New Jersey Stas. Rpt. 1891, pp. 275–419, figs. 81*).

Synopsis.—The author reports on the work of the year, notes being given on field experiments with fungicides, herbarium work, the Russian thistle and thistle-like plants (see p. 689), a leaf blight of oats, some of the more injurious fungi to fruits in 1891, some of the more injurious fungi upon market-garden crops, some fungus diseases of ornamental plants, and poisonous plants of New Jersey (see p. 689).

Field experiments with fungicides (pp. 275–302).—This report is a reprint of Bulletin 108 of the station (E. S. R., 6, p. 994).

Herbarium work (pp. 303, 304).—The author gives a list of the sets of fungi possessed by the station. The number of specimens is over 11,000, all of which have been mounted and classified. Card catalogues have been prepared, one classifying the specimens by orders and another according to the host frequented.

A leaf blight of oats (pp. 319, 320).—Reports from various parts of the State complained of a serious trouble of the oat crop. The plants were stunted in a peculiar manner. Investigations showed present a species of Phyllosticta that was quite unlike any of the described species accessible to the author. The fungus is described as follows: "Pycnidia of our Phyllosticta vary in size from 150 to 250 μ. The spores average from 12 to 18 by 6 to 7 μ, and are of a peculiar boat shape; that is, broader at one end than the other, and somewhat long, pear-shaped, being colorless and without guttulæ."

The effect of the disease on the oat crop as given by the author is:

"Several fields were visited and their appearance was nearly the same in all localities. The oat plants were of small size, and on June 23, for example, not more than from 6 in. to 1 ft. in height, with occasional heads showing in the most forward places. At first sight the fields had a peculiar brownish color, which was due

to some of the plants having turned brown, the upper leaves sometimes showing a reddish color. Other plants were nearly of the normal green, but apparently stunted. In those places where the diseased plants made up a half or more of the stand the whole field was decidedly brown, and prospects for a crop were very poor. Other fields had not more than a tenth of the plants dying, and the crop with the exception of these looked fairly well."

Some of the more injurious fungi to fruits in 1894 (pp. 320–334).—The author has reported on the more serious attacks of fungi on the following fruits during the season: Apple, blackberry, cherry, cranberry, currant, gooseberry, grape, peach, pear, plum, quince, raspberry, and strawberry. A cane blight of the currant is described that is due to a species of Nectria nearly related to *N. cinnabarina*. Associated with it were often found other fungi, one of which, *Homostegia* sp., was very conspicuous. On account of the nature of the injury done by these fungi there seems no other remedy than to cut out the diseased portions or the whole cane when severely attacked.

Especial attention is called to the attack on pears, particularly Keiffers, by the fruit mold fungus *Monilia fructigena*. Any bruising or breaking of the skin of this very susceptible kind would result in an immediate attack, followed by the softening of the whole fruit. The remedy is obvious.

A phase of the strawberry leaf blight is described. The injury seriously affected the crop during the year. The affected plants were manifest by the wilting and curling of the leaves. When no parasites were present, the functions of the roots seemed to have been impaired. Spots of *Sphærella fragariæ* were noticed on the leaves and also on the petioles, where they seemed to cut off the circulation of the sap from the leaves, hence their wilting.

Some of the more injurious fungi upon market-garden crops (pp. 335–362).—The more injurious fungi of the following crops are enumerated and the severity of their attacks briefly described: Bean, beet, cabbage, carrot, celery, cucumber, eggplant, horseradish, lettuce, melon, onion, parsnip, peas, pepper, potato, salsify, radish, spinach, squash, sweet potato, tomato, turnip, and watermelon. The report on beet diseases is reprinted from Bulletin 107 of the station (E. S. R., 6, p. 905).

A serious attack of cucumber anthracnose due to *Colletotrichum lagenarium* is reported upon, and while the experiments are not completed, it is thought that the proper use of Bordeaux mixture or ammoniacal copper carbonate would prevent serious losses from this source.

Since the publication of Bulletin 76 of the station (E. S. R., 2, p. 416) the author has continued his investigations on the ring rot fungus of the sweet potato. It has been ascertained to be caused by the same fungus as the stem rot, *Nectria ipomœæ*. In one of its most striking phases the decay is said to take the form of a ring about midway of the root; hence the common name of ring rot. Over the surface of the decayed portions soon appears the pinkish growth that characterizes this fungus. The stem rot of the eggplant is due to the same cause.

In addition to the more common tomato diseases, a leaf blight, due to an undetermined species of Cylindrosporium, was noticed. The disease seems to have been widely spread, and when badly blighted the whole plant has a sickly appearance, but no large spots on its leaves.

Some of the fungus diseases of ornamental plants (pp. 362–401).—Under this heading are reported the condition of the following as affected by various fungi: Chrysanthemum, cosmos, dahlia, hydrangea, lilies, palms, pinks, primulas, rose, and violets. The report on chrysanthemum diseases was prepared by the author for the American Chrysanthemum Annual, and is here reprinted. The diseases described are a leaf spot due to *Septoria chrysanthemi*, chrysanthemum blight caused by *Cylindrosporium chrysanthemi*, and a new leaf spot due to *Phyllosticta chrysanthemi*. The remedies for these diseases are the more common fungicides, directions for the preparation of the small quantities usually needed being given.

The stem blight of cosmos has already been noticed in these pages (E. S. R., 6, p. 437).

Specimens of diseased lilies were examined by the author for the suspected "Bermuda lily disease," but upon investigation the trouble was found to be due to species of Phyllostica and Vermicularia, the first being probably the primary cause of the disease. In other instances lack of vigor in plants was found due to the presence of mites in the bulb scales. For the prevention of the mites the use of sulphur water is advised.

For the diseases of primulas, five of which are mentioned, an occasional spraying of the plants with Bordeaux mixture is recommended.

The author has made an extended study of the diseases of the violet, due to various causes, but principally to *Phyllosticta violæ* and *Cercospora violæ*. Bench and box experiments were conducted for the prevention of the diseases with Bordeaux mixture, ammoniacal copper carbonate, and corrosive sublimate. Bordeaux mixture was the only one giving satisfactory results. Half strength mixture applied every 10 days to violets under glass was found to retard the time of blooming, and it is thought that quarter strength would be effective in preventing disease and would not be subject to this objection. Plants in the open field should be sprayed at least every 10 days with half-strength solution.

Attention is called by the author to the serious blighting of many flowers by *Monilia fructigena* and other fungi.

A reprint is given of a paper by the author on "How to distinguish fungus diseases of carnations." (E. S. R., 6, p. 832.)

A nursery blight of poplar, due to *Marsonia populi*, is figured and described. The white poplar, *Populis alba*, seems most subject to its attack. A similar disease has been observed for several years on the sycamore trees, causing the twigs to die back for several inches from their tips.

A reprint from *The Florists' Exchange* of October 6, 1894, is given on the "Vocation of the Phytopathologist."

Smut fungi, II, O. BREFELD (*Untersuchungen aus dem Gesammtgebiet der Mykologie, XI, pp. VI, 98, pls. 5; abs. in Amer. Naturalist, 30 (1896), No. 350, pp. 137–142*).—This article deals with the smut diseases of cereals, and is based upon 4 years' work of the author with *Ustilago carbo* on oats, *U. cruenta* on sorghum, and *U. maydis* on corn. Inoculations were made by spraying the plants at different stages of growth with conidia propagated in nutrient solutions made from fresh horse dung.

In the case of oats sprayings, made when the embryo was 1 cm. in length, gave from 7 to 10 per cent smutty plants; when 2 cm. long they gave 2 per cent; and when the plumule had pushed through the enfolding sheath scarcely any smut resulted. The infection takes place through the young axis and also through the sheathing leaf, but principally through the former. In another experiment garden soil was sprayed with conidia and oats planted at a depth of 1 cm., and after sprouting the plants were transplanted. In one lot of 300 seed 5 per cent of the resulting plants were infected. In a duplicate experiment 4 per cent were diseased. In still another experiment horse dung was mixed with soil and the whole infected and sown with oats. Half the resultant seedlings were kept in the laboratory at a temperature of over 15° C., the others being placed in a cellar where the temperature did not exceed 7°. Those in the laboratory gave 27 to 30 per cent smutted plants, while the percentage of smut in the ones in the cellar was from 40 to 46, showing that horse dung and low temperature are favorable for smut infection. A fourth series of experiments was made with infection material derived from conidia that had been artificially cultivated for 6 and 12 months. With the first cultures the author got from 7 to 10 per cent smutty plants, in the second almost none, the conidia having lost their power of sending out germ tubes capable of infecting the host. It was also learned that the germ tubes can penetrate any of the young tissues of the seedling, but can only infect the host when the hyphæ are able to reach the part of the plant where the smut beds are formed. In all experiments the germ tubes entered the young seedlings, but when they were unable to reach the incipient ovules no smut beds were formed, the germ tubes being embedded in the tissues of the host.

In the case of the sorghum experiment the results were even more striking than with oats. In some cases as much as 70 per cent of the sprayed plants became infected. Like the oats, the smut bed is confined to the panicle, and most of the infections took place in the early stages of growth, the tissues of the seedling soon becoming too hard for penetration.

In the experiments with maize 3 unexpected facts were brought out: (1) The germ tubes are capable of penetrating any rapidly growing part

of the plant; (2) the growth of the fungus hypha, which has gained entrance to the host is narrowly localized, the smut bed being formed near the place of infection; (3) there is no long period of time between infection and the development of spores, as is the case in oats and sorghum, but 2 or 3 weeks intervening in the maize experiments. The author conducted experiments with seed treated with smut; plants sprayed in their early stages of growth and at various later periods; upon the adventive aërial roots; upon leaves and upon the inflorescences, and in every case any meristematic part of the maize plant was liable to direct infection.

Corn smut, unlike that of the oats and sorghum, is provided with aërial conidia, which are readily transported from the soil where they are developed to any part of the plant. On this account the desirability of keeping the soil of the cornfield free from smut spores by removing and burning all smut masses before they have ripened is apparent. The spores of corn smut seldom germinate in water, and the infection of the plant probably takes place only when the spores have germinated in the soil and produced aërial conidia, their germination being greatly favored by the presence of horse dung.

Raspberry anthracnose, J. H. PANTON (*Ontario Agl. College and Exptl. Farm Rpt. 1891, p. 7, fig. 1*).—The author popularly describes and figures the anthracnose of raspberries due to *Glæosporium venetum*. This disease, while attacking both the red and black-cap varieties, is said by the author to be most severe on the black caps. The method of treatment suggested is the use of Bordeaux mixture made of 4 lbs. copper sulphate, 4 lbs. lime, and 50 gals. of water, applied as follows: "First application, early in the spring before the leaves open; 2d, soon after the young canes appear, and these only sprayed; 3d, about 2 weeks later spray young canes again; 4th, the young canes just before blooming. Cut out and burn the fruiting canes each summer as soon as the crop is gathered."

Diseases affecting the grape, J. H. PANTON (*Ontario Agl. College and Exptl. Farm Rpt. 1891, pp. 8–13, figs. 8*).—In reply to a circular of inquiry sent out relative to grape diseases, 120 correspondents reported the presence of downy mildew, 105 powdery mildew, 106 black rot, and 14 anthracnose. The loss due to disease was estimated at from 50 to 75 per cent of the crop. The varieties most subject to fungus attacks are Rogers' hybrids, Concord, Clinton, Niagara, Brighton, and Delaware. They seem to suffer injury in the order named, the first being the most severely attacked.

The author describes and illustrates downy mildew, black rot, powdery mildew, and anthracnose, and suggests preventive treatment for each.

On some characters of floral galls, C. MACMILLAN (*Science, n. ser., 3 (1896), No. 62, pp. 346–349*).—A synoptical résumé of the subject is given.

On the rust of flax and the microbes producing it, S. WINOGRADSKY (*Naturw. Rund., 11 (1896), No. 9, p. 112; abs. from Compt. Rend., 121 (1895), p. 742*).

A new parasite of the grape, Ravaz and Gouirand (*Rev. Vit.; abs. in Le Monde des Plantes, 5 (1896), No. 76, pp. 57, 58*).—Descriptive notes are given of *Phyllosticta vialæ*, n. sp.

A new sweet-potato disease, I. Clendenin (*Bot. Gaz., 21 (1896), No. 2, p. 92, pl. 1*).—Notes are given of a fungus found upon sweet potatoes imported from Java. Specimens were submitted to Ellis and Everhart, who describe the fungus as new and named it *Lasiodiplodia tuberculata*.

Gummosis of sugar cane, E. W Knox (*Rev. Agr. Île Maurice, 9 (1895), No. 12, pp. 289–294*).—Reprinted from *Sugar Journal*.

Concerning the sugar-cane disease caused by Marasmius sacchari, J. H. Wakker (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 2–3, pp. 44–56, figs. 5*).—Descriptive notes are given of this disease and suggestions offered for its prevention.

Violet damping, H. Melde (*Amer. Florist, 11 (1896), No. 404, p. 787*).—Coke screenings recommended as a remedy.

A new disease of wheat, P. A. Saccardo and A. N. Berlese (*Riv. pat. Veg., 4 (1895), p. 56; abs. in Hedwigia, 35 (1896), No. 1, Repert., p. 21*).—The disease affects the culms at their base, and is caused by *Sphæroderma damnosum*.

Root diseases caused by fungi, G. Massee (*Kew Misc. Bul., 1896, No. 109, pp. 1–5, pl. 1*).—Notes are given of *Dematophora necatrix* and *Rosellinia radiciperda*, the latter from New Zealand. Suggestions are given for their prevention.

The animal parasitic diseases of plants, A. B. Frank (*Breslau: 1896*).

Eel worms, J. N. May (*Amer. Florist, 11 (1896), No. 404, pp. 787, 788*).—These nematodes, which are said to be always found on clover roots when root galls are present, easily find their way to chrysanthemums and roses.

Eel worms affecting roses, J. N May (*Amer. Florist, 11 (1896), No. 399, p. 649*).—Brief remedial notes on nematodes attacking the roots of roses, and causing the foliage to become yellow. Watering with lime water or a solution of soda is recommended, and as a preventive steaming all suspected soil at a temperature of 235° F.

A report on experiments in treating nematodes with gas liquor, A. Stift (*Neue Ztschr. Rubenz. Ind., 36 (1896), Nos. 8, pp. 81, 82; 9, pp. 94–99*).

Arsenical cure for carnation rust, Hill (*Florists' Exchange, 8 (1896), No. 9, p. 192*).—Fowler's solution—1 oz. to 8 gals. of water—used with success.

How to prevent smut, J. H. Panton (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 17, 18*).—Directions are given for the treatment of seed with hot water, solutions of copper sulphate, and potassium sulphid for the prevention of smut.

Experiments in the treatment of carnation rust, F C. Stewart (*Florists' Exchange 8 (1896), No. 8, pp. 167, 168*).—Experiments are reported in testing the germination of spores in fungicides, soaking cuttings in the same, and on the curative and preventive treatment of rust. The author recommends the selection of resistant stock, dipping cuttings in solution of potassium sulphid and starting in fresh sand, spraying with weak copper sulphate solution, fumigating with sulphur before benching, and not allowing the foliage of indoor plants to remain wet for any considerable time.

Results of 6 years' combating black rot M. Bussière (*Prog. Agr. et Vit., 25 (1896), No. 6, p. 153*).

Grape mildew and the salts of copper, L. Degrully (*Prog. Agr. et Vit., 25 (1896), No. 6, pp. 141–143*).

Forest fungi, B. D. Halsted (*Forester, 2 (1896), No. 2, p. 25*).—Notes are given on cedar apples and their relation to diseases of the apple.

Diseases of plants and their remedies, N. A. Cobb (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 858–867, figs. 13*).—Notes are given on the pimply rot of the tomato, bitter pit of the apple, squash tip disease, a coffee disease, red blotch of lemon, gray scab of lemon, and an earthworm pest.

Diseases of agricultural plants and their remedies (*Fuhling's landw. Ztg., 45 (1896), No. 4, pp. 135–138*).—Brief notes are given on diseases of alfalfa, clover, lupine, vetches, and horse beans.

ENTOMOLOGY.

Report of the entomologist, J. B. SMITH (*New Jersey Stas. Rpt. 1894, pp. 423–600, figs. 58*).

Synopsis.—This report consists of a general review, comprising brief notes on a number of the insects most injurious during the season, with more extended remarks upon some especially damaging forms, particularly some scale insects, shade-tree insects, and insects affecting the wood of fruit trees.

General review (pp. 423–462).—In this connection short observations are made upon the San José scale, pear midge, pear psylla, pear blister mite, imported pear borer, fruit bark beetle, apple borers, tent caterpillar, peach borers, elm leaf beetle, wood leopard moth, periodical cicada, cutworms, melon lice, potato stalk borer, tomato or corn worm, corn root webworm, wheat insects, root maggot, thrips, cabbage insects, potato insects, blister beetles, sweet-potato insects, clover leaf beetle, asparagus beetle, blackberry insects, sawfly larvæ, wireworms, strawberry weevil, cranberry grasshoppers, squash borer, ants, may beetles, horn fly, and rose chafer.

Broadcast applications of kainit, at the rate of 500 lbs. per acre, were found efficient against maggots of cabbages, onions, and radishes. It was found that cranberries were eaten by grasshoppers, but only after the skin had been punctured by katydids or locusts.

Entomology in the crop bulletin (pp. 462–470).—This briefly reviews and abstracts the weekly information obtained from different parts of the State throughout the season, and indicates at what points the various injurious insects were most numerous and damaging.

Specially injurious insects (pp. 470–600).—In this part of the report are given general life history and remedial notes on scale insects as a class. Caustic washes, chiefly potash soapsuds, to be followed by kerosene emulsion, are recommended. Illustrated descriptive, life history, and remedial notes are given on the San José scale, taken in main part from Bulletin 106 of the station (E. S. R., 6, p. 832). Continued experiments with insecticides indicated that fish oil soap is the most effective wash. Illustrated notes are also given on the oyster shell bark louse (*Mytilaspis pomorum*), scurfy scale (*Chionaspis furfurus*), rose scale (*Diaspis rosæ*), soft scales (*Lecanium hesperidum*, *L. hemisphæricum*, and *L. cerasifex*), and cottony maple scale (*Pulvinaria innumerabilis*). The matter published in Bulletin 103 of the station (E. S. R., 6, p. 649) in regard to the elm leaf beetle (*Galeruca xanthomelæna*), wood leopard moth (*Zeuzera pyrina*), and white marked tussock moth (*Orgyia leucostigma*) is given in main part, supplemented by further observations on the life history and best methods of treatment. The bagworm (*Thyridopteryx ephemeræformis*) is also treated of at length, its life history being described and its anatomy and various stages figured in detail. Notes on cutworms, the sinuate pear borer, and potato stalk borer and experiments with bisulphid of carbon are given, being quoted from Bulletin

109 of the station (E. S. R., 7, p. 40). The report also includes notes on the life history of the pear midge (*Diplosis pyrivora*), the fruit bark beetle (*Scolytus rugulosus*), apple twig borer (*Amphicerus bicaudatus*), and the periodical cicada (*Cicada septendecim*).

The fruit bark beetle was found seriously damaging apple, pear, and peach trees, the infested trees appearing as if fine shot had been fired into the bark. These holes are the openings into galleries in which the eggs are laid and from which the larvæ bore beneath the bark on all sides. The central gallery, in which are laid about 80 eggs, is about 1½ in. long. The life cycle from egg to adult is about 35 days, and although the broods are not well marked, there are 4 or 5 in a season. The full-grown larvæ are white, thickened anteriorly, with small, yellowish heads and brown mandibles, and are about three-sixteenths of an inch long, while the black, cylindrical adult measures one-eighth inch in length. As a rule healthy trees are not attacked unless there is a dearth of weak or dying ones. It is recommended that badly infested trees be cut down and burned, while those only slightly attacked should have the borers cut out, the wounds plastered up, the trunk whitewashed, and the growth stimulated by abundant soluble fertilizers.

The apple twig borer was found attacking apples, pears, peaches, and grapes, boring into the previous year's growth, the burrows being made for food and shelter only, as the insects breed on the dead wood of smilax and wild grape. Ridding the land as completely as possible of the food plants is suggested as a remedy.

The periodical cicada caused some alarm in the State, but it is not believed that any damage due to the laying of its eggs will be of a serious nature.

Report of the entomologist, F. M. WEBSTER (*Ohio Sta. Rpt. 1891, pp. XXIX–XXXIX, figs. 7*).—In this report it is urged that more extensive appropriations are required to secure efficient combating of the insect pests of the State. Brief mention is given of the life history of the raspberry gouty gall beetle (*Agrilus ruficollis*), grape root worm (*Fidia viticida*), Western corn root worm (*Diabrotica longicornis*), chinch bug (*Blissus leucopterus*), asparagus beetle (*Crioceris asparagi*), onion thrips (*Limothrips tritici*), strawberry worm (*Harpiphorus maculatus*), cabbage curculio (*Listronotus appendiculatus*), and a few other species causing varying amounts of damage throughout the State. Maps are given showing the distribution in the State of the Western corn root worm, chinch bug, grape root worm, asparagus beetle, bagworm, clover root worm, and clover leaf weevil. Other investigations on the life history and best treatment of these pests are being carried on.

Insecticides, R. H. PRICE (*Texas Sta. Bul. 36, pp. 649–651*).—General remarks upon insecticides, explaining their purpose and methods of application to the two styles of insects, biting and sucking. The action of the following insecticides is described and directions given

for their application: London purple, Paris green, kerosene emulsion, carbon bisulphid, and pyrethrum. The forms of spraying apparatus that have proved most efficient at the station are mentioned and the names of the manufacturers furnishing them are given.

Trapping codling moths, J. H. PANTON (*Ontario Agl. College and Exptl. Farm Rpt. 1891, p. 4*).—Brief mention of an experiment in using funnel-shaped "tree protectors," which are fastened around the trunks of apple trees to capture codling moth larvæ. The larvæ found hiding places under tow attached to the apparatus, and 25 trees so treated averaged 25 larvæ each.

Peripatus, myriapods, and insects, A. SEDGWICK, F. G. SINCLAIR, and D. SHARP (*London and New York: Macmillan & Co., pp. XI, 584, figs. 371*).—In this volume, which is the fifth of the Cambridge Natural History Series, the different subjects designated in the title are separately treated by the respective authors. The plan of the work is to describe the origin, embryology, anatomy, morphology, life history, and distribution of the groups under consideration, combined with a discussion of relationships, and a general classification. Synoptical keys are given as far as the families, and in some cases to lower subdivisions.

The first 26 pages and 14 figures are devoted to Peripatus, its position between the Annelids and Arthropods being explained by an exposition of its anatomy and development, *P. capensis* being chiefly used for illustration. Ten distinct species and a number of doubtful ones are recognized, and a colored map given showing the geographical distribution of the genus.

The myriapods are classified as Chilognatha, Chilopoda, Schizotarsia, Symphyla, and Pauropoda, and an illustrated key to the families is given, in which a representative of nearly every family is figured. General remarks on the life history, and habits of the group preface technical descriptions of the structure of each class.

Nine orders of insects are recognized—Aptera, Orthoptera, Neuroptera, Hymenoptera, Coleoptera, Lepidoptera, Diptera, Thysanoptera, and Hemiptera, and the classifications of other authors are discussed. Although the paleontology, anatomy, and development of insects as a class are given with considerable detail, this volume treats elaborately only of the Aptera, Orthoptera, Neuroptera, and part of the Hymenoptera, the other orders to be considered in succeeding volumes.

This work is admirable in conception and execution, and will readily be granted highest rank as a handy reference book on the morphology of the forms considered, while the systematic side of the subject is not neglected. The illustrations are particularly good, many of them being original, and others taken from important special papers, in some cases not easily accessible.

Plants and ants, HEIM (*Rev. Sci., ser. 4, 5 (1896), Nos. 9, pp. 259–271, figs. 6; 10, pp. 299–303*).

On Aleurodes loniceræ, J. W. DOUGLAS (*Ent. Monthly Mag., ser. 2, 7 (1896), No. 74, pp. 31–33*).—Descriptions of the various stages.

The life history of the Wâwâlan, L. ZEHNTNER (*West Java Sugar Sta. Contr. 17, n. ser., 1895, p. 12*).—Notes on the scarabeid *Apogonia destructor*, which is very injurious to sugar cane in Java.

Aspidiotus perniciosus and Aonidia fusca—a question of identity or variation, W. M. MASKELL (*Canadian Ent., 28 (1896), No. 1, pp. 14–16*).—The author believes that it may be necessary to remove *Aspidiotus perniciosus* to the genus Aonidia, and to make *Aonidia fusca* a variety of *perniciosus*. The chief difference between the two is that of size and minor external variations, the anatomical features within the scale being practically the same.

The Coccinellidæ of Japan, G. LEWIS (*Ann. Mag. Nat. Hist., ser. 6, 17 (1896), No. 97, pp. 22–41*).—An annotated catalogue of 61 species.

New Culicidæ from North America, D. W. COQUILLETT (*Canadian Ent.*, *28* (*1896*), *No. 2, pp. 43, 44*).—Three new species of mosquitoes are described.

The probable origin, development, and diffusion of North American species of the genus Diabrotica, F. M. WEBSTER (*Jour. N. Y. Ent. Soc.*, *3* (*1895*), *No. 4, pp. 158–166*).—It is believed that all but one of the 18 species originated in Mexico and Central America, and have thence spread to the North, the Rocky Mountains dividing the current, and sending 2 species to the Pacific Coast.

Observations on Dolerus palustris, S. DOEBELI (*Ent. Nachr.*, *22* (*1896*), *No. 2, pp. 21–23*).—During the day the larvæ inhabit the stems of *Equisetum limosum*, issuing at night to feed on the branches.

Carpocapsa pomonella, a nut feeder, R. ADKIN (*Entomologist*, *29* (*1896*), *No. 392, pp. 2, 3*).—The codling moth has been bred from walnuts and sweet chestnuts.

The American species of Isotoma, A. D. MACGILLIVRAY (*Canadian Ent.*, *28* (*1896*), *No. 2, pp. 47–58*).—This consists of a revision and synoptical key, 31 species being recognized.

Lepidopterous larvæ in walnuts, F. V. THEOBALD (*Entomologist*, *29* (*1896*), *No. 393, pp. 28, 29*).—The species *Carpocapsa splendana* and *Plodia interpunctella* were found in English walnuts.

Lixus concavus as an injurious insect, E. A KLAGES (*Ent. News*, *7* (*1896*), *No. 1, p. 13*).—Brief notes on this beetle attacking rhubarb, burdock being the natural food plant.

Monocrepidius vespertinus injuring beans, J. B. SMITH (*Ent. News*. *7* (*1896*), *No. 1, p. 10*).—A short note on the adults gnawing bean pods.

Breeding notes on Scolytus 4-spinosus, S. rugulosus, and S. muticus, E. A. KLAGES (*Ent. News*, *7* (*1896*), *No. 1, pp. 11, 12*).

A descriptive catalogue of the Sphingidæ found within 50 miles of New York City, W. BEUTENMÜLLER (*Bul. Amer. Museum Nat. Hist.* *7* (*1895*), *pp. 275–320, pls. 6*).

Remarks and observations on the structure of the antennæ of the Cecidomyids, J. J. KIEFFER (*Bul. Soc Ent. France*, *1896*, *No. 2, p. 37, figs. 2*).

Bibliography of North American dipterology, 1878–'95, I, S. W. WILLISTON (*Kansas Univ. Quarterly*, *4* (*1895–'96*), *No. 3, pp. 129–144*).

The compound stigmata of dipterous larvæ, J. C. H. DE MEIJERE (*Tijdschr. Ent.*, *38* (*1894–'95*), *pp. 65–100, figs. 33*).—An important paper, based on studies of the metamorphoses of *Hydromyza livens*, but including comparisons with several other species.

Predaceous and parasitic enemies of Aphides (**concluded**), H. C. A. VINE (*Internat. Jour. Micr. and Nat. Sci.*, *ser. 3*, *6* (*1896*), *No. 29, pp. 35–45, pls. 2*).—A semipopular discussion of the life history and relationship of various insects preying upon Aphides.

The anatomy and physiology of the ovaries of worker ants, E. E. BICKFORD (*Zool. Jahrb.*, *9* (*1896*), *No. 1, pp. 1–27, pls. 2*).—This paper records the results of the study of several species of ants, in some of which the workers were found capable of laying fertile eggs. The plates illustrate the histology of the ovaries.

The lateral organs of scarabeid larvæ, F. MEINERT (*Kgl. Dansk. Vidensk. Selsk. Skr.*, *ser. 6*, *8* (*1895*), *No. 1, pp. 72, pls. 3*).

British and European butterflies and moths, A. W. KAPPEL and W. E. KIRBY (*Nuremburg: E. Nister, 1895, pp. 273, pls. 30, figs. 7*).

The life histories of the New York slug caterpillars, I, H. G. DYAR and E. L. MORTON (*Jour. N. Y. Ent. Soc.*, *3* (*1895*), *No. 4, pp. 145–157, pl. 1, figs. 16*).—Detailed descriptions.

The nesting habits of Anthidium consimile, A. DAVIDSON (*Ent. News*, *7* (*1896*), *No. 1, pp. 22–26, figs. 3*).—Illustrated notes on the nests of this bee, which consists of 6 or 7 celled masses of sand glued on branches or in the angles of rocks.

New experiments on the seasonal dimorphism of Lepidoptera, A. WEISMANN (*Entomologist*, *29* (*1896*), *No. 393, pp. 29–39*).—Recounts experiments with butterfly eggs laid at Naples, adults being reared both at Naples and Freiburg, Germany.

The effect of higher temperature on the immature stages is to produce darker adults, an effect that it is believed becomes hereditary.

Some aspects of hibernation, F. A. DIXEY (*Ent. Record, 7 (1896), No. 7, pp. 169–173*).—A philosophical discussion, in which the author states that hibernation is originally due to a protoplasmic adaptation for rest, afterwards influenced by natural selection.

The origin of insect transformations, G. H. BRYAN (*Internat. Jour. Micr. and Nat. Sci., ser. 3, 6 (1896), No. 29, pp. 57–60*).—The writer states that the separation of the functions of nutrition and locomotion has caused insects to become more highly developed in their final stage and to degenerate in their early stage.

Early stages of some bombycid caterpillars, A. S. PACKARD (*Jour. N. Y. Ent. Soc., 3 (1895), No. 4, pp. 175–180*).—Detailed technical descriptions of immature forms.

Senses of insects, G. A. K. MARSHALL (*Entomologist, 29 (1896), No. 393, pp. 42–48*).—A paper discussing the sense of hearing in sound-producing insects, Cicada, Termites, etc., and noting interesting observations and experiments.

The value of formalin for preserving insects, K. ESCHERICH (*Ent. Nachr., 22 (1896), No. 1, pp. 1–3*).—Formalin is recommended as preserving the colors as well as the insects themselves.

New remedy for phylloxera (*California Fruit Grower, 18 (1896), No. 8, p. 114*).—A brief note on successful French experiments, in which peat moss, moistened with oil of schist, was hoed in the soil about the bases of the vines. Repeating this procedure twice a year destroyed the pest.

Martini's insecticide against the grape moth, the tortrix of the pome fruits, and other insects, G. DEL GUERCIO (*Staz. Sper. Agr. Ital., 28 (1895), No. 12, pp. 749–761*).

Things old and new in agriculture, A. CASALI (*Cose vecchie e nuove in agricoltura. Castrocaro: A. Barboni, 1895, pp. 77*).—A reprint of a series of articles published in an agricultural periodical, *La Pastorizia*, on how to prevent or avoid the phylloxera. The author treats of the reasons why sandy soils are unfavorable to phylloxera, the emanations from cultivable lands, hilly lands, and the phylloxera, and the function of iron in plants.

Injurious insects and fungi, (*Jour. [British] Bd. Agr., 1895, No. 2, pp. 162–182, figs. 6*).—This comprises illustrated descriptive, life history, and extended remedial notes on the damson mite (*Bryobia pruni?*), pea beetle (*Bruchus pisi*), bread beetle (*Sitodrepa panicea*), pine beetle (*Hylobius abietis*), turnip flea (*Phyllotreta nemorum*), cucumber and turnip mildew (*Oidium balsamii*), and club root of turnips (*Plasmodiophora brassica*).

Detailed accounts of experiments with different remedies are given and directions included for the use of those found most efficient.

Injurious insects (*Jour. [British] Bd. Agr., 1895, No. 3, pp. 300–316, figs. 3*).—Notes on the life history and treatment of the woolly aphis (*Schizoneura lanigera*), goat moth (*Cossus ligniperda*), cabbage root maggot (*Phorbia brassicæ*), and wireworms (*Agriotes lineatus, A. sputator*, and *A. obscurus*). The remedial measures recommended to be used against these pests are, except in the case of the goat moth, chiefly taken from the publications of various American experiment stations, especially the Cornell Station.

FOODS—ANIMAL PRODUCTION.

Note on nukamiso, M. INOUYE (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 4, pp. 216–218*).—This substance is rice bran in the state of lactic fermentation, and is used for softening certain vegetables, such as the eggplant and radish, which are rendered more palatable and more easily digestible when left in a large quantity of nukamiso for about 24 hours, after which the mixture is carefully washed from the

articles which have been treated with it. Notes are given on its preparation and analyses of the substance as used. The products treated with this mixture are said to acquire a peculiarly fine flavor, and a greater digestibility is secured by the softening of the vegetable cells through the action of the lactic acid contained in the preparation.

The preparation and chemical composition of tofu, M. INOUYE (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 4, pp. 209–215*).—Directions are given for the preparation of this food from soja beans, and analyses of the product. Tofu is one of the chief sources of protein in portions of Japan. As this food is freshly made every day and there is no bacterial action connected with its preparation, the author states that the name "vegetable cheese" is not justified.

On the influence of the use of sugar on muscular work, B. K. STOKVIS (*Diet. and Hyg. Gaz., 12 (1896), No. 1, pp. 31–35*).—This article was read before the section of physiology of the British Medical Association at London, July–August, 1895. By means of experiments it was demonstrated that the immediate combustion of sugar does not exercise a beneficial effect on the amount of muscular work which can be performed. The work done in the experiments consisted in lifting a weight with the hand. The amount was measured with an instrument called the ergograph. A large number of experiments were made and the results tabulated. Various sorts of sugar were experimented with.

Sugar and starch are slowly assimilated and stored up in the muscles as reserve material. The combustion of this reserve material (sugar) yields energy, and, "although it can not be contended that the chemical energy produced by the combustion of sugar is one of the chief sources of muscular work, yet there is no plausible reason why, in order to promote muscular work, sugar should be added to the daily food. All other carbohydrates will do as well for the provision of the muscular storehouse with the necessary stock of chemical energy."

Cod-liver oil as a food adjunct (*Molk. Ztg., 9 (1895), No. 9, p. 125*).—It is said that cod-liver oil is being recommended in England in rations for milch cows, pigs, and dogs. It is claimed that it increases the fat content of the milk, without injuriously affecting the quality. Being an animal fat it is said to be more easily digestible than many vegetable fats used in rations for calves, and is recommended for that purpose. Experiments are suggested on its effect on the quality of meat, milk, and bacon.

Beet-sugar molasses for milch cows, horses, and pigs, I. INSULANDER (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 246–251*).—Favorable experience concerning the feeding of beet-sugar molasses to milch cows, horses, and young pigs. Cows were fed up to 1½ kg. (3.3 lbs.) per day per head, diluted with double its weight of water and poured over the grain feed. Working horses were fed 1 kg. (2.2 lbs.) per head daily. Molasses was fed to pigs with skim milk, taking the

place of potatoes. The author believes that molasses is likely to become a very important food for farm animals.—F. W. WOLL.

Fodders and feeds (*New Jersey Stas. Rpt. 1894, pp. 173–206*).—Analyses are given of crimson clover, cowpea vines, cornstalks, fodder corn, corncob, corn grain, starch feed (wet), cerealine feed, dried brewers' grains, wet brewers' grains, mangel-wurzels, cotton-seed meal, cotton-seed feed, koji feed, oat chop, peanut meal, T. B. Milk Producer, and Economic Feed VI. Several of these are quoted in the following table:

Analyses of commercial feeding stuffs.

	Water.	Crude fat.	Crude fiber.	Crude protein.	Crude ash.	Carbo-hydrates.	Albuminoid nitrogen.	Nitrogen.	Phosphoric acid.	Potash.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Cerealine feed	10.14	8.53	6.33	11.46	2.60	60.94	1.72	1.83	1.26	0.67
Cotton seed feed	9.73	3.30	35.72	10.74	3.65	36.86	1.60	1.72	0.62	1.21
Koji feed	8.00	4.22	16.27	19.01	6.61	45.89	2.59	3.04	3.25	0.96
Peanut meal	10.87	2.38	62.87	7.03	2.14	14.71	0.96	1.13	0.15	0.62
T. B. Milk Producer	9.88	6.05	5.06	27.26	3.50	48.25	4.01	4.36	1.50	0.78
Economic Feed VI	10.70	5.90	6.90	22.81	4.75	48.94	3.17	3.65	1.43	0.55

Some of the samples of which analyses are quoted were described in detail.

The feeding stuff sold as peanut meal consisted of ground shells or hulls. It was largely crude fiber and even less valuable as a food than cotton hulls. Cows eating it suffered from severe indigestion.

"T. B. Milk Producer is doubtless a mixture of feeds; it corresponds very closely with some dried brewers' grains in its content of fat and protein, though much richer in the mineral constituents phosphoric acid and potash. An even mixture of cotton-seed meal and wheat middlings, or gluten meal and wheat bran would give products quite similar to this in composition. At the selling price, $23 per ton, it furnishes the food constituents at a very reasonable cost, and will doubtless serve an excellent purpose as a feed ration for dairy cows in connection with coarse products.

"Cotton-seed Feed is claimed to consist of 1 part of cotton-seed meal and 5 parts of cotton hulls, and the analysis shows this claim to be fulfilled. The chief value of this product from the standpoint of actual nutritious compounds lies in the meal contained in it, the hulls serving mainly as bulk. At the price per ton charged—$15—it is a very expensive feed, since $5 would purchase an equivalent amount of meal, leaving a charge of $10 for the remaining material, which is of but little more value than good straw."

The article also contains a report on the market prices of a large number of commercial feeding stuffs from 1891 to 1895, an article on gluten feeds reprinted from Bulletin 105 of the station (E. S. R., 6, p. 839), and the average composition of a large number of feeding stuffs, mostly compiled.

Cotton-seed hulls and meal for beef production, F. E. EMERY and B. W. KILGORE (*North Carolina Sta. Bul. 118, pp. 219–238*).

Synopsis.—Tests were made with 4 fat steers. It was found they could not be fed a heavy ration of cotton-seed hulls and meal for a long period with profit. The digestibility of the ration, the effect of cotton-seed meal on the digestibility of hulls, and the fertilizing constituents of the rations fed were also discussed.

The experiment was made with 4 steers. Nos. 1 and 2 were mature oxen and had been worked. They were fed for 96⅔ days a heavy ration of cotton-seed hulls and meal in the proportion of 2:1. Nos. 3 and 4 were young and had probably never been worked. They were fed for 135 days a heavy ration of cotton-seed hulls and meal in the proportion of 3:2. The rations were fed *ad libitum*. The steers were fat when purchased and cost 2.75 cts. per pound.

The results are tabulated for each steer, showing the gains in weight, the amounts of food and of digestible nutrients consumed, temperature of the stable, water consumed per pound of dry matter eaten, etc.

Steer No. 1 gained 173 lbs., and No. 2, 185 lbs. The cotton-seed hulls are valued at $3 and meal at $24 per ton. The 2 steers gave a net profit of 74 cts. for the whole period. For shorter time the profits were larger, $3.21 for 81 days and $5.71 for 63 days. No. 3 gained 148 lbs., and No. 4, 252.2 lbs. On the heavier ration Nos. 3 and 4 were fed at a loss of $11.90 for the whole period. For a period of 40 days there was a profit of $1.83. The heavy rations were profitable for a considerable time, although the cattle were fat when purchased.

Digestibility of the rations fed in the foregoing experiments (pp. 238–244).—On 4 consecutive days of each of the last 2 weeks the feces of each of the steers were collected. The analyses of these and of the feeding stuffs are given in tabular form, together with the digestion coëfficients as determined. The digestion coëfficients for the rations were as follows:

Coëfficients of digestibility of rations of cotton-seed meal and hulls fed to steers.

	Dry matter	Ash.	Protein	Fat	Nitrogen-free extract	Crude fiber
	Per cent	*Per cent*	*Per cent.*	*Per cent*	*Per cent*	*Per cent*
Steer No. 1	55 53	39 20	65 16	86 04	56 15	45.21
Steer No. 2	54 58	37 37	62 88	82.36	53.49	47.18
Average	55 06	38 29	64.02	84.20	54 82	46.20
Steer No. 3	56 68	38 29	64 61	91 49	56.78	49 70
Steer No. 4	55 39	29.50	65 56	79 19	55 93	45.78
Average	56.04	38.90	65.09	85 34	56.36	47.74

With a view to ascertaining whether the digestibility of the cotton-seed hulls was affected by feeding cotton-seed meal with them, the digestion coëfficients of the hulls as fed above were calculated, using the coëfficients for cotton-seed meal previously obtained by the station (E. S. R., 5, p. 1081).

"The calculated digestibility of the hulls in the rations is greater in every case, and in some instances materially more so, than the average of 4 experiments show them to have been when fed alone. There has been a decided retardation in the digestibility of protein in every case, due to the combinations. It is as though no protein has been digested from the hulls, while they have caused a decreased digestibility of the protein of the meal by the amounts indicated in the table expressed in per cent of the protein fed in the hulls. But the loss in protein is more than counterbalanced

by the increased digestibility of carbohydrates. The gains in nitrogen-free extract and crude fiber were sufficient to increase, after bringing up the loss from protein, the digestible dry matter from 0.81 per cent in the 7 to 1 ration to 8.66 per cent in the 3 to 1 ration. This is quite a decided and important increase. In the light of these experiments, we can not, therefore, answer otherwise than that cotton-seed meal does effect and increase the digestibility of cotton-seed hulls."

Fertilizer constituents (pp. 245–253).—The fertilizer constituents recovered in the manure from the rations fed in the digestion experiments of the present series and others previously reported[1] were calculated and arranged in tabular form. The feces were analyzed in every case and the urine in 5 trials. The average percentages of the fertilizer constituents in the food recovered in the excreta in these 5 trials are shown in the following table:

Average composition of excreta in 5 experiments with cattle.

	Nitrogen	Phosphoric acid	Potash.
	Per cent.	*Per cent.*	*Per cent.*
Urine and feces	89.8	88.0	92.4
Urine	50.3	18.5	58.7
Feces	39.5	69.5	33.7

"These results show that an average of 90 per cent of the total fertilizing constituents contained in the rations were excreted in the manure, corresponding to 89.8 per cent of the fertilizing value; that 42.5 per cent of these constituents were contained in the urine, corresponding to 50.2 per cent of the money value; while the dung contained 47.5 per cent of the fertilizing constituents, corresponding to 39.6 per cent of the original manurial value of the rations. These figures make apparent the value of urine as a fertilizer, especially where nitrogenous rations are fed. The urine is especially rich in nitrogen and potash, while most of the phosphoric acid is contained in the solid excrement. The average value of the urine per day for 5 animals was 7.14 cts. against 5.63 cts. for the solid excrement for the same time and animals. The value of the manure depends on the foods fed."

In calculating the manurial value nitrogen is valued at 17 cts., phosphoric acid at 4½ cts., and potash at 5 cts. per pound.

"The obtainable manurial value of the rations is in all cases materially greater than the original cost of the foods making the rations. The average cost of the daily rations of the 5 animals was 9.53 cts., valuing cotton-seed meal at $18 and hulls at $3 per ton. The average total manurial value of the same rations was 14.22 cts., and the obtainable manurial value 12.77 cts. The obtainable manurial value of the rations (12.77 cts.) is 134 per cent of the original cost of the rations (9.53 cts.). It is as though the growth and fattening of the animals were obtained for nothing, and there was still a balance of 34 per cent of the original cost of the foods in the manure pile to the credit of the feeder. These results would not be obtained in ordinary practice, since no account is taken of the unavoidable loss in handling and resulting from decomposition. Neither do these figures take into account the cost of feeding and applying the manure to the land."

"Slopping" cows, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 148, 149*).—In November and December 9 cows were fed

[1]North Carolina Buls. 80*c*, 87*d*, and 97 (E. S. R., 3, p. 452; 4, p. 736; 5, p. 1081).

a grain ration of 2 lbs. of ground wheat and 4 lbs. of bran in addition to silage, and pasturage during the day for a part of the time. The first 2 weeks the grain was fed dry, the next 2 weeks one-half of it was mixed with warm water to a slop, and the last 2 weeks the whole grain ration was made into slop.

"Some of the cows increased in the quantity of milk and in the percentage of fat, while others decreased during the period of slopping once a day." The total milk yield was 3,062 lbs. during the first period, 3,157 during the second, and 2,940 during the third; the average percentage of fat was 3.96, 3.82, and 3.86, respectively.

Later 6 cows were given for a time nearly all their drink in the form of slop. The weekly average showed "a decrease in the quantity of milk by 25 lbs., while the per cent of fat remained about the same.

"There does not appear to be any advantage in feeding cows wet meal, nor is there evidence to prove that this method of feeding will make the milk poorer in fat to any extent."

Experiments on the effect of food on milk, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1891, pp. 117, 118*).—At the time the college herd was turned to pasture, May 14, the cows were divided into 2 lots, lot 1 receiving 4 lbs. of bran, 3 lbs. of wheat, and 1 lb. of cotton seed per head, and lot 2 only 1 lb. of bran.

The yields of milk and fat before and after turning to pasture are given. "Group 1 gained 0.37 per cent fat, and group 2, 0.45. Group 1 failed to the extent of 43 lbs. milk, and group 2, 67 lbs. milk. We evidently were not paid for the meal on good pasture."

At the end of this trial, June 3, both lots were given only pasturage, with a very little bran. From June 12 to July 1 both lots decreased in quantity and per cent of fat in milk, as compared with the previous period. From July 1 to 22 both lots were fed 2 lbs. of bran and 2 lbs. of wheat per cow daily, and July 10 1 lb. of cotton-seed meal was added. Compared with the previous period, when no grain was given, both lots decreased in milk yield, but the percentage of fat remained practically the same.

Sheep feeding in Colorado, W. W. COOKE (*Colorado Sta. Bul. 32, pp. 48*).

Synopsis.—Statistics on sheep raising in Colorado. Feeding experiments with different varieties of sheep showed that the best returns were given by Mexican yearlings. The first 5 pages of the article contain a popular summary.

The first part of this bulletin is devoted to a popular discussion of sheep raising in the State, with remarks on breeds, ranging, selling lambs, transportation, sheep markets, methods of feeding, death losses, shipping, cost of shipping, expenses of feeding, feeding Western lambs, feeding older sheep, and sheep statistics.

An experiment is reported with 4 lots of sheep "to ascertain the relative chances for profit in feeding Southern and Western sheep." Lot 1 was made up of 20 Western yearlings, selected for size and vigor,

averaging 118 lbs. in weight. Lot 2 was composed of 17 Western wether lambs and 3 ewes, "selected from a flock of 2,500 and represented the Western lamb in its best possible form." The average weight was 101 lbs. Lot 3 was composed of 12 yearling Mexican wethers, the average weight being 73 lbs. Lot 4 was made up of 28 Mexican lambs, the average weight being 63 lbs. at the beginning of the experiment.

From October 24 to November 19 the sheep were fed alfalfa hay only, the average amount consumed per head daily being 2.5 lbs. The gains were: Western yearlings, 10 lbs.; Western lambs, 6 lbs.; Mexican yearlings, 2 lbs., and Mexican lambs, 3 lbs. From November 19 to December 13 the alfalfa was increased to an average of 3.7 lbs. per head daily, but they lost in weight. In the author's opinion this is due to shrinkage in the water content of the system.

The sheep were then divided into 4 uniform lots of 20, each composed of 5 Western yearlings, 5 Western lambs, 3 Mexican yearlings, and 7 Mexican lambs. Each lot was put in a pen having a small open shed, which afforded little protection. This experiment lasted from December 13 to March 20.

In addition to an average of 3.4 lbs. alfalfa hay per head daily, lot 1 received until February 7, ½ lb. cracked wheat and 3 to 5 lbs. beets; lot 2, ½ lb. cracked wheat; lot 3, ½ lb. cracked corn, and lot 4, 3 to 5 lbs. beets. From February 7 to March 20, the amounts of wheat, corn, and beets were increased. The gain in weight made by each lot was as follows:

Gain in live weight of sheep by lots.

	Dec. 13 to Feb. 7.	Feb. 7 to Mar. 20.	Total from Dec. 13 to Mar. 20.
	Pounds.	*Pounds.*	*Pounds.*
Lot 1, cracked wheat and beets	356	305	661
Lot 2, cracked wheat	298	342	640
Lot 3, cracked corn	282	293	575
Lot 4, beets	331	276	607

In addition to the above, there are given for each kind of sheep the gains in weight per animal, the digestible matter consumed per pound of growth, and the cost of 1 pound of growth, as follows:

Food consumed and gains made from December 13 to March 20.

	Gain in weight per head.	Digestible matter eaten.		Value of food eaten.	
		Total.	Per pound of gain.	Total.	Per pound of gain.
	Pounds.	*Pounds.*	*Pounds.*		*Cents.*
Western yearlings	37	242	6.5	$1.49	4.2
Western lambs	38	228	6.0	1.43	3.8
Mexican yearlings	21	194	9.2	1.30	6.2
Mexican lambs	26	156	6.0	1.14	4.4

The sheep were again separated, each kind by itself, and from March 20 to April 10 were all fed daily an average of 2.38 lbs. alfalfa hay, 0.83 lb. cracked wheat, and 4 lbs. beets per head. The Western yearlings gained 9.4 lbs. per head, the Western lambs 12.1 lbs., the Mexican yearlings 5 lbs., and the Mexican lambs 4.4 lbs.

The animals were sold and slaughtered. The Western lambs were sold for $5.25 per 100 lbs., giving a profit of 71 cts. per head; Western yearlings for $4.75, giving a loss of 18 cts.; Mexican yearlings for $5.25, giving a loss of 5 cts.; and Mexican lambs for $5.85, giving a profit of 88 cts. "The Mexican lambs have made the most profit, whether figured per head or per dollar invested or per ton of hay fed."

The following conclusions are drawn:

"All the sheep made excellent gains. The Western lambs grew most rapidly, the Mexican yearlings the least. . . .

"Sugar beets proved an acceptable feed to the sheep, and the most rapid growth was made by those that had hay, grain, and beets. . . .

"Wheat and corn fed in equal quantities to like sheep gave just the same amount of growth, the same shrinkage in shipping, and the same dressed weight. . . .

"During cold weather the sheep ate more per head than in warm weather; but the cold did not interfere with their growth.

"The best gains in weight were made when the average daily temperature was below freezing."

The returns made per ton of each article of food consumed were also calculated.

Experiments in the piggery, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1891, pp. 149, 150*).—Two experiments were made, one to determine the relative value of wet and dry meal as a food for pigs, and the other to compare sweet milk and sour milk. In the first test 7 grade Berkshire pigs, averaging 148 lbs., were fed for 3 weeks on middlings made into a slop with skim milk, and some whole peas, and in 3 weeks following the same food dry. The total gain per lot was 142 lbs. on wet food and 171 lbs. on dry food. Practically the same amount of grain was required to produce a pound of gain whether fed wet or dry, but the pigs seemed to waste more of the dry feed.

The second test was with 11 Tamworth pigs, divided into 2 lots. Feeding middlings and peas, sweet milk and sour milk with some buttermilk were compared in alternating periods of 3 weeks. The total gain of the 2 lots while on sweet milk was 379 lbs. and while on sour milk 438 lbs., a difference of 59 lbs. in favor of sour milk. In the author's opinion the trial indicates that sour milk is equal to or better than sweet milk for pigs weighing from 140 to 200 lbs.

The use of maize as human food, E. M. SHELTON (*Queensland Dept. Agr., Bul. 70 (2d ser.), pp. 16*).—The value of Indian corn as human food from a practical and dietary standpoint is explained at considerable length. An analysis of corn is quoted and some practical suggestions are given regarding the grinding of the meal. A considerable number of recipes for cooking corn are included.

Butter and its substitute as food—a contribution to the margarin question (*Deut. landw. Presse, 23 (1896), Nos. 13, p. 107; 14, p. 113*).—A review of the subject comparing the nature and nutritive value of butter and margarin.

Utilization of the meat of tuberculous animals, C. MOROT (*Jour. Agr. Prat., 60 (1896), Nos. 9, pp. 325–329; 10, pp. 362–365*).—The author urges the importance of sterilizing the meat of tuberculous animals if it is to be used for food and refers to work which has been done in many places.

The use of sugar in agriculture for the food of animals, M. H. VINEEN (*Bul. Assn. Chim. Sucr. et Distill., 12, No. 11*).—An exhaustive treatment of the subject from a physiological and economical point of view.

Cacti as fodder plants, W. R. TROMP DE HAAS (*Orgaan Ver. Oudleer. Rijks Landbouwschool, 8 (1896), No. 90, pp. 7, 8*).

Removing the bitter and poisonous principles from lupine seeds (*Deut. landw. Presse, 23 (1896), Nos. 17, pp. 139, 140; 19, p. 161*).—A popular review of the subject.

Fruit as stock feed (*California Fruit Grower, 18 (1896), No. 10, p. 188*).—Comparison of various fruits with other foods.

On the value of different kinds of rape-seed cakes, V. STEIN (*Tidsskr. Landökon., 13 (1895), pp. 709–721*).—A general discussion of the adulteration and value of the different kinds of rape-seed cakes found on the market at the present time.

Feeding milch cows sesame cake, N. ROUCHÈS (*Jour. Agr., 7 (1896), No. 71, p. 26*).—It was found by experiment that with a ration containing sesame cake a cow gave 2 liters more milk per day than when sesame cake was omitted. The milk was richer in total solids and butter fat. The author regards sesame cake as a valuable feeding stuff.

Glossary of fodder terms, E. B. HOLLAND (*Massachusetts Hatch Sta. Bul. 33, pp. 1–8*).

Investigation of foods and condiments (*Ztschr. angew. Chem., 1896, No. 5, pp. 141–144*).—Analyses are reported of butter and beef fat, baby foods, sunflower-seed cake, brewers' grain cake, preserved pea soup, cheese, coffee and coffee surrogates, and several sorts of wine.

The food of man and its influence on strength and health, KLÖPFER (*Die Ernährung des Menschen und ihr Einfluss auf Arbeitskraft und Gesundheit. Kassel: 1895*).

The influence of alcohol on proteid metabolism, R. H. CHITTENDEN (*Diet. and Hyg. Gaz., 12 (1896), No. 3, pp. 153–155*).—The question is briefly reviewed and a number of recent experiments are quoted.

The nervous system and nutrition, J. P. MOROT (*Rev. Sci., ser. 4, 5 (1896), Nos. 7, pp. 193–199; 8, pp. 234–241*).—An extended review of the subject from a physiological standpoint.

The red Danish (Funen) dairy cattle, S. P. N. ANDERSEN (*Tidsskr. Landökon., 14 (1895), pp. 697–705*).

Fattening steers with a ration including fish meal (*Deut. landw. Presse, 23 (1896), No. 17, p. 145*).

Effect of whole-flesh meal and herring meal on milk production, and remarks on the plan of feeding experiments in general, J. SEBELIEN (*Landw. Vers. Stat., 46, No. 4–5, pp. 259–308*).—This is a detailed account of experiments in feeding whole-flesh meal and herring meal to cows, and remarks on the planning of feeding experiments to study the effect of food, mention of which was made in a previous number (E. S. R., 6, p. 927) in an abstract taken from another source.

Record of dairy herd for 1894, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 150, 151*).—A record is given for each of 29 cows. Only 4 of these were in the herd during the entire year, and the record for a number of them covers only a short period.

The Aveyron breed of sheep, H. GEORGE (*Jour. Agr. Prat., 60 (1896), No. 6, pp. 210–212, pl. 1*).—An illustrated description of this breed of sheep.

East Friesian milk sheep (*Deut. landw. Presse, 23 (1896), No. 20, p. 169, figs. 2*).

The Norwegian horse, W. HALLANDER (*Tidskr. Vet. Med., 14 (1895), pp. 129–143*).

VETERINARY SCIENCE AND PRACTICE.

Report of the biologist, J. NELSON (*New Jersey Stas. Rpt. 1894, pp. 219–272*).—This consists of an outline of the work done by the biologist for the State Tuberculosis Commission and a discussion of tuberculosis. The author discusses at length the contagiousness of bovine tuberculosis, stable sanitation, and the means of restricting the disease.

The environments of the 9 herds investigated were studied with reference to drainage, drink, feed, exercise, ventilation, light, and breeding, a scale of points being adopted in each case.

"On summing up all the marks given . . . I find that we get a standing of the herds ranging from 46 to 58 points. The highest number of points possible is 70. . . .

"When all things are considered, the difference in the sanitary conditions of our herds is not so great as we have usually thought it to be.

"These herds differed in the amount of infection from nothing to 65 per cent.

"There is absolutely no trace of a tendency to covariability with the sum of all sanitary conditions, nor with any one or more of the factors considered separately."

In this investigation on about 200 animals it was found that a number of animals that had the disease in slight degree failed to react when tested with tuberculin. Records of temperatures of animals tested are tabulated in detail, with special reference to determining the variation in an individual temperature from day to day and from hour to hour.

"The mean temperature of a herd varies from about 101 to 102.5°. There is a maximal mean at 8 and 10 o'clock in the forenoon, and a second maximal period at 4, 6, and 8 o'clock in the evening. Temperatures taken at these times would give the best indication, for most cases, of the highest points attained by the normal temperature. As reactions generally begin about 12 hours after injection, by timing the injection so that it shall come 12 hours earlier than these periods we would get the advantage of the normal tendency to rise superadded to the influence of tuberculin; so that if a decided rise occurs at 8 a. m. or 10 a. m., this being compared with the temperatures taken at these hours the previous day, we can most generally see if a reaction has taken place. It follows that 8 p. m. is the best time to make the injection, though a few hours earlier will not seriously affect this result, because the reactions last so long that they still occur during these maximal periods. . . .

"We find that each cow presents considerable variations in her temperature at the same hour on different days, and this may amount to a couple of degrees for 2 consecutive days."

An investigation was begun to determine whether degree of humidity of the atmosphere influences the temperature of an animal. The milk of tuberculous animals was investigated microscopically, but the results are not given.

Tuberculosis of cattle, L. PEARSON (*Pennsylvania Sta. Bul. 29, pp. 39*).

Synopsis.—A comprehensive account of tuberculosis, particularly as affecting cattle, treating of the history, infection, pathology, symptoms, diagnosis, and remedial measures.

Brief mention is made of researches on the cause of tuberculosis, and the tubercle bacillus and its properties are described. It is stated that

all domestic animals are subject to tuberculosis, the disease being most common in cattle and swine, and comparatively rare in sheep, horses, dogs, and cats. The tuberculous cattle in the United States are mainly to be found in the Atlantic States, the disease gradually becoming less prevalent toward the West and practically not existing on the plains. It is roughly estimated that from 2 to 5 per cent of our cattle are tuberculous to a greater or less degree.

Five modes of individual infection are cited: Congenital infection, and infection through the skin, the digestive tract, the respiratory tract, and the genital organs. The action of the tubercle bacillus by multiplying at the point of lodgment, irritating the surrounding tissues and causing the development of tubercles which finally degenerate, is described; and the lungs, lymphatic glands, pleuræ, and intestinal canal are stated to be the most common seats of attack. The udder is comparatively rarely affected.

Two classes of conditions are mentioned as favoring the development of tuberculosis: (1) Those reducing the vitality of the animal, and (2) those favoring the introduction of tubercle bacilli. In the first class heredity, conformation, irrational feeding and stabling, lack of exercise, uncleanliness, and excessive production of milk are included; while in the second is mentioned the exposure to diseased cattle, which is rendered more dangerous by lack of ventilation and faulty construction of stalls for the stabling of herds.

As the lungs are the organs most frequently affected, the most prominent symptoms are those connected with respiration, and physical diagnosis is commonly directed to this portion of the anatomy. A rough, harsh, dry cough is the most common symptom, in addition to which râles may sometimes be heard and areas of dullness revealed by percussion. Symptoms referable to tuberculosis in other portions of the body are also briefly cited. The methods sometimes attempted of examining the sputum and the milk of suspected animals under the microscope are believed not to be practicable.

The most reliable test for tuberculosis is stated to be the now commonly practiced injection of tuberculin. Originally tuberculin was made solely in Germany, but now is satisfactorily prepared in this country, chiefly by the Bureau of Animal Industry of this Department.

The method of injecting tuberculin is described with some detail, and it is stated that the tuberculin injected should consist of about 1 drachm of a 10 per cent solution in a 1 per cent solution of carbolic acid. It is urged that when it is possible to do so, the temperature of the animals should be tested every 3 hours during the 24 hours prior to the injection of the tuberculin. Before injecting the skin should be washed and disinfected, and the syringe needle should be as nearly aseptic as possible. After the injection the temperature should be taken in 3 hours and again in 8 hours, after which the temperature should be taken

every 2 hours for several intervals. If the temperature rises $1\frac{1}{2}$ degrees or more above the previously established normal within from 8 to 18 hours after the administration of the tuberculin, and remains high for at least 2 measurements with no evident cause of fever except the injection of tuberculin, this elevation is to be regarded as a reaction and indicative of the presence of tuberculosis.

Among precautions to be taken is the correct determination of the temperature before and after the injection, for which accurate thermometers should be employed. Occasionally the injection of tuberculin causes a slight falling off in the secretion of milk and also a slight diarrhea, trembling of the muscles, loss of appetite, and inflammation at the point of injection, but the effects are rare and develop only in tuberculous animals. The fever resulting from tuberculin injection is rarely accompanied by any depression whatever. In a few instances a permanent curative effect has followed the repeated injection of tuberculin, the tubercular lesions being surrounded by fibrous capsules, but the subject has not yet been thoroughly studied.

It is strongly urged by the writer that no injurious effect can follow the injection of tuberculin, and that when careful observations are made it is an unmistakable test of the presence of tuberculosis. A table of normal temperatures is given, showing observations made upon the station herd, from which tuberculous animals had previously been eliminated after injection of tuberculin, to prove that tuberculosis has not been caused by the injection of tuberculin.

Remarks are made upon the dangers of the disease both to cattle and to man, and of the special danger of tuberculin infection by the use of milk from diseased cattle. It is urged that all diseased cattle be removed from herds, the premises thoroughly disinfected, and faulty sanitary conditions corrected. The most satisfactory method of disposing of condemned animals is believed to be an outright destruction by burning or burial. It is believed that there is abundant proof that tuberculosis can be completely exterminated and the herds kept free from the disease for a period of years. The author regards it as cheaper to concentrate the loss from tuberculosis by immediately destroying such animals as are tuberculous rather than to permit the disease to drag along through several years and progressively destroy the herd as well as scatter infection elsewhere.

Report of the professor of veterinary science, J. H. REED (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 39–46*).—This report contains notes on the health of the farm animals of the herd during the year, sheep having suffered most; brief remarks on the dehorning of cattle at the college farm by means of saws, and elaborate temperature notes on tuberculin injections in the college herd. The test is believed by the author never to condemn a healthy animal, although in some cases diseased animals are not detected.

Diseases of animals in Great Britain and Ireland (*Jour.* [*British*] *Bd. Agr., 1895, No. 2, pp. 252, 253*).—Tabulated data on the number of cattle and swine slaughtered on account of having been diseased or suspected of being diseased with pleuro-pneumonia and swine fever, respectively, during the fiscal year 1894–'95. In addition, brief tabulated data are given on the number of animals attacked by anthrax, glanders, and rabies during the same period.

On epizoötic abortion, H. HOLM (*Tidsskr. norske Landbr., 2 (1895), pp. 285–293*).—A general discussion of the subject, with directions for the prevention of the disease.

Pernicious anæmia in horses in Norrland (Sweden), R. EKVALL (*Tidskr. Vet. Med., 14 (1895), pp. 208–220*).

Infectious brain fever in horses, A. FLORMAN (*Tidskr. Vet. Med., 14 (1895), pp. 232–236*).

On infectious bronchitis, A. FLORMAN (*Tidskr. Vet. Med., 14 (1895), pp. 102–105*).

Gastric fever in cattle, M. PAULSEN (*Mdskr. Dyrlæger, 7 (1895), pp. 257–310*).

On streptococcic inflammation of the udder of cows as a cause of acute gastro-intestinal catarrh in man, A. HOLST (*Mdskr. Dyrlæger, 7 (1895), pp. 314–317*).

Epizoötic lymphangitis in horses (*Tidskr. Vet. Med., 14 (1895), pp. 224–231*).

On the diagnosis of swine fever (*Tidskr. Vet. Med., 14 (1895), pp. 165–170*).

A case of tuberculosis in sheep, P. B. RASMUSSEN (*Mdskr. Dyrlæger, 7 (1895), pp. 338, 339*).

Larvæ of hycoderma in the brain of the horse, T. SEGELBERG (*Tidskr. Vet. Med., 14 (1895), pp. 144–148*).

Barium chlorid for colic (*Braunschw. landw. Ztg., 66 (1896), No. 3, p. 10*).

Studies on vaccinal immunity and the immunizing power of the serum of a vaccinated heifer, A. BÉCLÈRE and CHAMBON and MÉNARD (*Ann. Inst. Pasteur, 10 (1896), No. 11, pp. 1–46*).

On the serum treatment of tuberculosis, V. BABES and G. PROCA (*Compt. Rend., 122 (1896), No. 1, pp. 37–40; Rev. Sci., ser. 4, 5 (1896), No. 3, p. 85*).—Briefly recounts the results of numerous experiments with antituberculous serum and tuberculin, the conclusions being that repeated injections of large quantities of the serum, especially in combination with tuberculin, exert a decided curative effect on tuberculous animals and men.

Report of the Royal Veterinary Institute of Sweden for the year 1894, C. A. LINDQVIST (*Tidskr. Vet. Med., 14 (1895), pp. 67–101*).

DAIRYING.

Analyses of reindeer milk, F. H. WERENSKIOLD (*Tidsskr. norske Landbr., 2 (1895), pp. 372–375*).—The author analyzed 2 samples of reindeer milk. The albuminoids were determined by Ritthausen's method, casein and albumen according to Hoppe-Seyler's method, and globulin by the difference between these two determinations. Fat was determined after drying on granulated ignited pumice stone, with some powdered marble added, by extraction with pure ether. The author states that it has been found necessary in making gravimetric fat determinations to add powdered marble to samples of milk preserved by means of potassium bichromate, since "too high and often inaccurate results are otherwise obtained."

The 2 samples analyzed had the following composition:

Composition of reindeer milk.

	Sample 1.	Sample 2.
	Per cent.	*Per cent.*
Water	70.15	64.25
Ash	1.54	1.43
Fat	14.46	19.73
Milk sugar	3.02	2.61
Casein	8.06	8.69
Albumen	1.36	1.66
Globulin	0.35	0.56
Amids	0.56	0.56
Undetermined	0.50	0.51
Total	100.00	100.00

The specific gravity of sample 2 at 15° C. was 1.0477. The fat was present in the shape of globules, the diameter of which as determined in the second sample was found to range between 0.0017 and 0.0102 mm., the average diameter being 0.0047 mm.—F. W. WOLL.

The cream separator, deep setting, and shallow pans compared, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 112, 113*).—This is a continuation of studies made the previous year (E. S. R., 6, p. 476). From April to November, 1894, the herd milk was mixed and then divided into 3 portions, one run through a hand separator (Alexandra No. 8, Baby No. 2, or United States, hand size), another portion set in deep cans in ice water, "under the best conditions," and the third portion set in small, shallow pans. The milk in deep cans was set for an average of 20 hours and skimmed at an average temperature of 42° F., while that in shallow pans was set for 32 hours and skimmed at an average temperature of 54° F.

On the average for the whole season, the milk used contained 3.69 per cent of fat, and the average percentage of fat in the skim milk was 0.11 from the separator, 0.27 from deep setting, and 0.32 from shallow pans.

"On 1,419 lbs. milk, containing 52¼ lbs. fat, the loss in skim milk was 1.50 lbs. of fat by the separator method, 3.83 lbs. by deep setting, and 4.51 by shallow pan.

"During the tests of 1893 the loss of fat in skim and buttermilk from May to October (1,027 lbs. milk in each method) was 0.17 lb. fat by the separator, 1.67 lbs. by deep setting, and 3.29 lbs. by the shallow-pan method.

"The per cent of the total fat lost in the skim and buttermilk by the 3 methods for 2 years is:

Loss of fat in skim milk and buttermilk.

	1893.	1894.
	Per cent.	*Per cent.*
Separator	1.2	3.5
Deep setting	4.3	7.9
Shallow pan	8.5	9.6

"The per cent of fat lost is greater in all 3 methods during this year, although they hold the same relative positions as last year.

"The cream from each lot of milk was churned separately, and samples kept for testing as to keeping quality. In nearly every case the butter made from the separator cream was best at the end of 2 to 4 weeks. Just after churning there was not much difference in the 3 lots of butter.

"The average time required to churn the separator cream was 26 minutes, deep setting 31 minutes, and shallow pan 35 minutes. The per cent of fat in buttermilk was 0.175 from separator, 0.16 from deep setting, and 0.30 from shallow pan.

"The yield by the churn from 1,419 lbs. milk was 59½ lbs. worked butter by separator method, 59 lbs. by deep setting, and 58 lbs. 2¼ oz. from shallow pan.

"The difference would be greater than this, according to the manner of using setting methods, as commonly practiced on the farm."

Milk set in shallow pans in warm vs. cold temperature, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, p. 114.*)—This is a continuation of previous work (E. S. R., 6, p. 476). Trials were made in May and November, one lot of milk in every case being set at an average temperature of 54° F., and the other at an average of 45° F. "There was not much difference in the 12 trials, and in nearly every case the lower temperature gave slightly better results."

How long does it take all the cream to rise on milk set in a deep pail? H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 113, 114*).—A number of trials were made in August and November by setting milk in deep pails in ice water from 4 to 12 hours. In every case 12 hours gave the best result.

In December, when a greater proportion of the cows were "strippers," the milk was set for 12, 24, and 36 hours. The conclusion was that such milk should be set at least 24 hours.

Similar trials were made with milk set in shallow pans for 24 and 36 hours. The latter time gave the more nearly complete creaming. "The character of winter milk seems to be such that a longer time is required for the cream to rise perfectly, and we would advise 24 hour settings for deep pails and 36 hours for shallow pan."

Composite testing, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 114-117*).—An account is given of trials in preserving composite samples with potassium bichromate, showing that the samples may be preserved for 3 or 4 weeks without material loss; and illustrations of the application of composite testing in paying for milk, showing the reliability of the method as ordinarily practiced. Incidentally the yield and composition of the morning's and night's milk of the college herd are given, showing that "the cows invariably gave more milk in the morning." Although "the milk averaged a higher percentage of fat in the evening for the 6 months, in some cases the morning milk was higher in fat percentage."

A comparison of the yield of butter with the radiator and with the separator and churn, L. F. NILSON and K. SONDÉN (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 206-215*).—The "radiator," a new butter extractor invented by the Swedish engineer G. Salenius, was

compared with an Alpha separator and a so-called Holstein churn as regards butter-producing capacities. The radiator separates the milk and churns the cream in the upper portion of the bowl. It works continuously when running, delivering skim milk through one tube and butter with buttermilk through the other. A little more than 1 lb. of buttermilk is obtained for every pound of butter, *i. e.*, 4 to 5 per cent of the milk run through the machine. As soon as the buttermilk is worked out of the butter, it is again run through the radiator after having been mixed with a certain quantity of skim milk.

The capacity of the radiator used was 650 liters per hour and the separator 1,200 liters per hour. The radiator was run at the rate of 6,000 and the separator 5,600 revolutions per minute. In each comparative trial 750 kg. of milk, containing about 3.25 per cent of fat, was divided into 2 equal parts, the milk having in all cases been previously pasteurized at 64° C. in a Fjord pasteurization apparatus. The main average data of the trials made were as follows:

Comparative trials of radiator with separator and churn.

	Obtained from 750 kg milk			Fat content of—			Water content of butter	Milk required per kg of butter.	Proportion of fat in milk recovered in butter
	Skim milk	Butter milk	Butter	Skim milk	Butter milk	Butter			
Series 1 (5 trials)	*Kg*	*Kg*	*Kg*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Kg*	*Per cent*
Radiator	690.6		27.67	0.19	....	79.20	17.80	27.15	89.8
Separator and churn	610.9	106.4	26.92	0.12	0.63	85.37	11.61	27.91	94.1
Series 2 (3 trials)									
Radiator	.		27.46	......	......	81.04	15.63	27.31	92.7
Separator and churn	..		26.45	....	......	85.21	12.36	28.35	93.9

The yield of butter with the radiator was larger than that from the separator and churn, on account of the higher water content of the radiator butter. The second series of trials was undertaken to decrease, if possible, the water content of this butter. It was worked a third time in this series, after having been kept in a refrigerator for 8 to 12 hours. The results obtained are satisfactory, and show that with the plan of work followed the radiator will do as good work as a separator and churn combined as regards the production of butter. The working of the new machine during the trials was pronounced excellent. An illustrated description of the machine is given in the paper.—F. W. WOLL.

The composition of milk, cheese, and whey in relation to one another, A. E. SHUTTLEWORTH (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 20–33*).—This is an account of cheese-making experiments during a part of each month from May to November. The milk of the college herd was used, supplemented by milk purchased from outside. The milk was in each case divided into 2 lots, according to the percentage of fat, and 300 lbs. each of the richer and poorer milk was used in each trial. The data for the cheese-making experiments and the com-

position of the milk, cheese, and whey are tabulated and summarized. In all 180 complete analyses were made, representing 30 separate samples each of milk, cheese, and whey. A summary of these experiments is given in the following table:

Summary of experiments in making cheese from richer and poorer milk

	Richer milk.				Poorer milk.			
	Total solids.	Fat.	Casein.	Green cheese made from 100 lbs. milk.	Total solids.	Fat.	Casein.	Green cheese made from 100 lbs. milk.
	Per cent.	*Per cent.*	*Per cent*	*Pounds*	*Per cent.*	*Per cent*	*Per cent.*	*Pounds.*
May and June	12.62	3.92	2.33	10.53	12.12	3.30	2.22	9.62
July and August	12.70	3.85	2.34	10.24	11.88	3.15	2.10	9.00
September, October, and November	12.67	3.90	2.31	10.53	11.90	3.29	2.23	9.55

The relation of the fat to casein in milk and the method of paying for milk at cheese factories are also discussed and data given bearing on these points.

"Since the fat and the casein of milk go to form fully 55 per cent of the weight of its cheese, and since the fat of milk varies considerably, but casein slightly, it follows that equal quantities of milk of increasing percentages of fat yield under normal conditions increasing quantities of cheese, but that the yield of cheese per pound of fat gradually decreases. Consequently fat alone can not accurately determine the cheese-producing power of milk. [The poorer milk], averaging for the whole season 3.248 per cent of fat, yields 2.89 lbs. of cheese per pound of fat; while [the richer milk], averaging for the whole season 3.890 per cent of fat, yields only 2.65 lbs. of cheese per pound of fat."

The amount to be paid for the richer and the poorer milk on the basis (1) of the weight of the milk, (2) of the percentage of fat in milk, and (3) of the percentage of fat plus the casein is discussed and shown in the table. The conclusion is reached that the latter is the fairer basis. The average percentage of casein found was 2.27, and in calculating the amounts to be paid this figure was added to the percentage of fat; that is, the patron was given credit for both the fat and the casein furnished. This number for casein is believed to be applicable to milks averaging between 3.25 and 3.90 per cent of fat, "but it must not be accepted as final and applicable for very rich or very poor milk without further investigation."

The conclusions drawn from the season's experiments are as follows:

"(1) Taking the average of several samples, a relatively larger yield of cheese is obtained from relatively richer milk, but the increased yield of cheese is proportionately less than the increased percentage of fat in the milk.

"(2) Under normal conditions of milk, curd, etc., the percentage of fat in cheese varies closely with that in the milk from which it is made.

"(3) Under normal conditions of milk, curd, etc., a slightly higher percentage of fat is found in whey from rich than from poor milk.

"(4) The development of a gassy curd decreases the yield of cheese from a given quantity of milk.

"(5) Casein in milk does not increase proportionately as the fat.

"(6) Milk poor in fat makes more cheese per pound of fat than milk richer in fat.

"(7) That the greatest degree of care must be exercised in handling milk, from the time it is drawn from the cow until made into cheese, to secure a maximum yield of cheese.

"(8) While fat as a basis in distributing dividends is fairer than the common method, a still fairer basis is the sum of the fat and the casein of the milk. This sum is obtained by adding an average percentage of casein to the fat reading."

Experiments in cheese making, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 134-141*).—These experiments were similar to those described above, and are discussed in much the same way. The details of the manufacture are given, together with the data secured, and the basis for the payment for milk is also discussed.

Being summed up, the 7 months' results show:

"(1) 12,600 lbs. milk with an average of 3.94 per cent fat yielded 1,236¼ lbs. cured cheese, while the same quantity of milk testing 3.37 per cent fat produced 1,123 lbs cheese—a difference of 112¾ lbs. cheese in favor of the richer milk. The difference in the average per cent of fat is 0.57.

"(2) The average pounds of milk required to produce a pound of cured cheese from 3.94 per cent milk was 10.19; from 3.37 per cent milk the average was 11.22—a difference of 1.3 lbs. milk in favor of the richer milk.

"(3) The average pounds of cheese produced from 1 lb. of fat in the richer milk (3.94 per cent fat) was 2.50, and from the poorer milk (3.37 per cent fat) there was produced 2.65 lbs. cheese—a difference in favor of the poorer milk of 0.15 lb. cheese for each pound of fat.

"(4) The loss of fat in whey, as determined by the Babcock tester, was 0.19 per cent for the richer milk and 0.18 per cent for the poorer.

"(5) The cheese made from the richer milk shrank 5.2 per cent when weighed at the end of a month, while the cheese made from the poorer milk shrank 5.5 per cent in the same time. There was little difference in the per cent of shrinkage of the cheese made from the 2 lots of milk. The greatest shrinkage was during the months of May and June (and the richer milk cheese in July), and the least during November; but these latter cheeses were not so well cured as the others.

"The results indicate that adding 1 or even 2 per cent to the fat readings in these tests is more nearly correct than paying by weight of milk or by the fat alone.

"It will be remembered that these experiments refer to normal milk, and can not be compared with skimmed or watered milk. On the 7 months' transactions the patron sending the richer milk (3.94 per cent fat) would receive 6 cts. more than he should receive according to yield of cheese, and the other patron sending 3.37 per cent milk would receive 2 cts. less than he ought, if the basis of adding on 2 per cent to fat readings were adopted."

Report of Vesteraas Chemical-Control Station for 1894, J. O. BERGSTRAND (*Vesteraas (Sweden): 1895, pp. 16*).—The average fat content of 14,252 samples of new milk examined during the year was 3.63 per cent; of separator skim milk, 0.15 per cent (280 samples); of gravity skim milk, 0.58 per cent (28 samples); and of buttermilk, 0.41 per cent (40 samples).

The radiator (*Landmansblade, 28 (1895), pp. 654-656*).—A description of the new Swedish combined cream separator and butter extractor, with illustrations.

Milk aërators, B. BÖGGILD (*Ugeskr. Landm., 41 (1895), pp. 605-607*).

Normandy butter (*Tidn. Mjölkhushaalln., 4 (1895), p. 214*).

Building plans for coöperative creameries (*Tidsskr. Landökon., 14 (1895), pp. 600-615, pls. 15*).

Report of the experiment station and school for dairying at Kleinhof-Tapiau, 1895 (*Molk. Ztg., 10 (1896), No. 1, p. 3*).—A summary of lines of work without discussion of results.

Traveling dairy, H. H. DEAN (*Ontario Agl. College and Exptl. Farm Rpt. 1894, pp. 152–155*).—A review of the work done by the traveling dairy during the year in different counties.

TECHNOLOGY.

Sulphurous acid, acid phosphate, and lime as clarifying agents, W. MAXWELL (*Louisiana Stas. Bul. 38, 2d ser., pp. 1395–1408*).—At a temperature not much above 40° F. the action of sulphur dioxid in converting sucrose of cane juice into glucose was extremely small, but at 150° F. sulphuring resulted in 23 per cent of the total sucrose being destroyed. Hence the author advises that no heat be turned on the sulphured juice in the clarifiers until it has been brought to neutrality with lime. When sulphuring occurred at 195° F., and after heating the uice for an hour, only a small part of the sucrose escaped destruction.

"If the juice is limed to slight alkalinity before condensing to sirup, the invertive action of the sulphur appears to be modified somewhat. If the juice is left on the side of acidity before evaporating down to sirup, the heating of the sirup after sulphuring causes a notably greater inversion."

Two samples of juice were brought to the same degree of acidity, the one being sulphured and the other treated with acid phosphate. The amount of inversion in the 2 acidulated juices was practically identical.

"The observations in brief upon the subject of impurities removed from the cane juice by acids are as follows: Sulphurous acid and acid phosphate remove the albuminoids, but do not act on or precipitate any of the so-called pectinous or gum substances, the same being observed in noting the action of these acids on these sirups. Further, lime not only aids in removing the albuminoids, but also appears to be the only clarifying agent in common use which acts in removing from the juice any part of the gums."

Quantitative determinations were made of the organic and mineral impurities removed from the juice by sulphurous acid and lime and acid phosphate and lime. When sulphur was used there was no increase of purity, but with acid phosphates there was a notable improvement in this respect.

"All the observations made upon the action of sulphurous acid and acid phosphate on the coloring matters, . . . indicate that acid phosphate is a more effective precipitant of those pigments than sulphurous acid. Sulphurous acid neutralizes the color, but the pigment remains indefinitely in suspension, and will not be removed from the juices in clarification."

The author's studies led to the conclusion that at low temperatures sulphurous acid did not permanently destroy the coloring matters in cane juice, and also to the conclusion that sulphurous acid can exercise a special bleaching action which other acids no not exercise.

A study of the fermentations of cane juices was conducted, but the detailed results are reserved for future publication.

Cane sirup, B. B. Ross (*Alabama College Sta. Bul. 66, pp. 185–193, fig. 1*).—These experiments were undertaken to show that the purification of cane juice before evaporation is simple and can be carried out successfully on a small scale.

In the apparatus described by the author the cane juice is allowed to flow slowly over 2 series of 3 shelves each, fastened to opposite sides of an air-tight box 1 by 2½ by 4 ft. This box is kept filled with the fumes of burning sulphur from a small furnace underneath. After the juice thus treated and placed in a shallow copper evaporator had nearly reached the boiling point, a small amount of thin milk of lime was added, the juice being left distinctly acid. The material that rose to the surface while boiling was carefully skimmed off. The sirup was boiled to a density of 32° Baumé, at which it kept without crystallizing or souring. The use of sulphur fumes is said to give a lighter colored product, to tend to prevent fermentation, and to aid in the removal of impurities. Sirup, prepared as above, was kept 11 months in tightly sealed bottles without change.

Milling vs. diffusion, W. Maxwell (*Hawaiian Planters' Monthly, 14 (1895), No. 6, pp. 255, 256*).

Summary of experiments in reboiling low-grade sugar, E. E. Olding (*Hawaiian Planters' Monthly, 14 (1895), No. 6, pp. 259, 260*).

Analyses of Bohemian raw sugars, Bröz (*Bohm. Ztschr. Zuckerind., 1895, No. 20, p. 182*).

The use and effect of pure yeasts in wine making, J. Wortmann (*Anwendung und Wirkung reiner Hefen in der Weinbereitung. Berlin: Paul Parey, 1895, pp. 62, figs. 12; abs. in Centbl. Bakt. und Par. Allg., 1 (1895), No. 22–23, pp. 823, 824*).

On the racking of wines, J. Perraud (*Prog. Agr. et Vit., 2 (1895), No. 46, pp. 526–529*).

Studies of the musts of different varieties of cider apples, M. E. Herissant (*Bul. Min. Agr. France, 14 (1895), No. 5, pp. 569–607*).—Tabulated analyses of 72 fresh ciders, with records of specific gravity, taste, and progress of fermentation for over a year.

Process for preventing the blackening of cider, L. Dufour and L. Daniel (*Compt. Rend., 122 (1896), No. 8, p. 494*).—The addition of 10 to 15 gm. citric acid per hectoliter is recommended for cider which alters slowly, 20 to 30 gm. for that blackening more rapidly, and as much as 50 gm. for cider exceptionally rich in tannin, and consequently blackening with great rapidity.

Improvements in the manufacture of vinegar, J. Holt and J. G. Lorrain (*Jour. Soc. Chem. Ind., 14 (1895), No. 12, p. 1057.*)—A patented process for oxidizing fermented wort by means of nascent oxygen, resulting from electrolysis.

Beechnut oil, C. H. La Wall (*Amer. Jour. Pharm., 68 (1896), No. 1, pp. 11–18*).

Pressing castor oil, (*Indian Agr., 20 (1895), No. 12, p. 378*).

Purification of cotton oil (*Chem. Ztg., 19 (1895), No. 93, p. 2085*).

Cotton-seed oil and meal (*Amer. Fert., 4 (1896), No. 1, pp. 30–32*).—Recent statistics regarding this industry are briefly reported.

Cotton-seed oil, A. R. Lewis (*Amer. Jour. Pharm., 68 (1896), No. 1, pp. 42–45*).

Manufacture of peanut oil, A. M. Villon (*Jour. Pharm. et Chim., ser. 6, 15 (1895), No. 12, p. 555*).

The astringent barks of India (*Indian Agr., 20 (1895), No. 12, p. 360*).

Catechu (Cutch) and Katti (*Indian Agr., 20 (1895), No. 12, pp. 368, 369*).

STATISTICS.

Abstract from the Annual Report of Delaware Station for 1894 (*Delaware Sta. Bul. 26, pp. 11*).—This consists of brief popular accounts of the work of the station during the year on the following topics: Anthrax; tuberculosis; hydrophobia; spinal meningitis in horses; controlling the grain weevil; strawberry root aphis; San José scale; currant scale insect; tests of varieties of grapes, tomatoes, apples, peaches, and strawberries; attempts to destroy Canada thistle and sodom apple; sorghum investigations; milk testing; pea-vine silage; clover a cheap substitute for commercial fertilizers; spring-sown crimson clover; Egyptian clover; spurry; muriate of potash on crimson clover and on sweet corn; and weather records.

Reports of directors and treasurers of New Jersey Stations (*New Jersey Stas. Rpt. 1894, pp. XV, 3-11, XII, 211-216*).—Brief general remarks on the work of the year, and treasurers' reports for 1894.

Thirteenth Annual Report of Ohio Station for 1894 (*Ohio Sta. Rpt. 1894, pp. I-XLII*).—This contains short reports of the board of control, treasurer (for the fiscal year ending June 30, 1894), director, agriculturist, horticulturist, entomologist, botanist, and chemist, some of which are mentioned elsewhere.

American agriculture and agricultural institutions for research and instruction, M. MÄRCKER (*Berlin: P. Parey, 1895, pp. 79*).—The author discusses the agricultural features of the Columbian Exposition and describes 4 American farms as examples of agricultural management. Under the head of agricultural institutions he refers at length to several divisions of this Department and to the experiment stations of California, Wisconsin, New York (State), New York (Cornell), Connecticut (State), Connecticut (Storrs), and Minnesota.

The author discerns a more practical trend of agricultural experiments in this country than in Germany, and ascribes it to the different conditions in the two countries. He states that German experiment stations need attached farms similar to but smaller than those of the American experiment stations on which to demonstrate the results of work obtained in the vegetation house. The differences between American and German agricultural colleges and schools are discussed.

First principles of agriculture, E. B. VOORHEES (*Boston: Silver, Burdett, and Co., 1896, pp. 212*).—This book is written for a text-book in the country district schools. Its purpose "is to state in logical order the elementary principles of scientific agriculture and to show the relation of these scientific facts to farm practice."

The subjects treated of are the constituents of plants; origin, formation, composition, and improvement of soils; natural manures; artificial and concentrated manures; the rotation of crops; the selection of seed; farm crops and their classification; cereals; grasses; pastures; roots; tubers; market-garden crops; the growth of animals; the constituents of animals and animal food; the character and composition of fodders and feeds; the digestibility of fodders and feeds; feeding standards; nutritive ratio; the exchange of farm products for concentrated feeds; principles of breeding; the pure breeds of farm stock; the products of the dairy, their character and composition, and dairy management.

NOTES.

INDIANA STATION.—The station has undertaken the publication of a new class of periodical bulletins on "Animal Diseases in Indiana." These will be published at frequent intervals, possibly once a month, and are to include returns by veterinarians in different parts of the State of outbreaks of animal diseases.

MASSACHUSETTS COLLEGE.—E. A. Jones, of New Jersey, has been appointed superintendent of the college farm.

MISSOURI STATION.—A horticultural laboratory has just been completed, containing 3 glass compartments for experimental and instructional work in horticulture and vegetable physiology. The main central room is 30 by 30 ft. and 27 ft. high at apex of roof. Two wings are connected with it, each 30 by 22 ft. It is heated by steam from a separate boiler house, each compartment having independent coils. The cost of the building, including heating arrangements, was $5,000.

A department of entomology has been added to the college and experiment station, occupying the entire second floor of the horticultural building. J. M. Stedman, B. S., has been appointed professor of entomology and entomologist of the station. A complete equipment for laboratory and field work is being put in, and an insectary will be erected in the near future. Arrangements have been made for conducting experiments in methods of combating some of the more injurious insects in the localities in which they are doing the greatest damage.

MONTANA COLLEGE AND STATION.—A. M. Ryon, mining engineer, and Luther Foster, agriculturist, have resigned their positions in the college and station, to take effect June 30.

NEBRASKA STATION.—The following have been added to the station staff: Frederic W. Taylor, secretary; O. V. P. Stout, B. C. E., irrigation engineer.

NEW HAMPSHIRE STATION.—Prof. F. W. Morse assumed the duties of vice-director of the experiment station May 1. Mr. Clement S. Morris is at present acting clerk, succeeding Mr. Fitzgerald.

NEW MEXICO STATION.—At the annual election of the faculty and station staff of the New Mexico College of Agriculture and Mechanic Arts and Agricultural Experiment Station, the following changes were made: C. T. Jordan, of Virginia, was elected president of the college and director of the station; John D. Tinsley, of Virginia, was elected to take charge of the department of biology, which is to include the former departments of botany and entomology; W. W. Robertson, of Texas, was chosen professor of English, and is to assume general supervision of the subfreshman class, which takes the place of the preparatory department; George Miles, of New Mexico, was elected professor of astronomy and principal of the business department; and F. O. Kihlberg, of Las Vegas, was elected superintendent of the Las Vegas substation.

NEW YORK STATE STATION.—The following changes have been made in the board of trustees of the station: W. S. Barnes has been succeeded by Nicholas Halleck, of Queens, Long Island; Charles Jones by F. O. Chamberlain, of Canandaigua; and L. D. Olney by F. C. Schraub, of Lowville.

OKLAHOMA COLLEGE AND STATION.—The following appointments have been made, E. E. Bogue, B. S., graduate and post-graduate student of Ohio State University, acting professor of botany and entomology and botanist and entomologist of the station; J. W. Fields, B. S., graduate of Pennsylvania State College and formerly

assistant in Pennsylvania Station, assistant in chemistry and physics in college and station; and J. H. Bone, B. S., graduate of Ohio State University, assistant in agriculture in college and station.

RHODE ISLAND COLLEGE AND STATION.—The management and control of the farm has been transferred from the station to the college. The station retains a tract of about 30 acres for experimental purposes and also has use of a barn and poultry yards.

VERMONT STATION.—C. H. Jones, of the Massachusetts State Station, has received a temporary appointment as assistant chemist in connection with the fertilizer control work of this station.

TERRESTRIAL MAGNETISM.—Beginning with January, 1896, there appeared under the above title the first number of an "international quarterly journal" edited by L. A. Bauer, of the University of Chicago, with the coöperation of 34 associates, including some of the leading physicists of the world. It is proposed to limit the journal "exclusively to terrestrial magnetism and its allied subjects, such as earth currents, auroras, atmospheric electricity, etc. . . . Primarily, the aim of this journal will be to create a broader sympathy and to afford an easier communication between widely separated workers in a field that is day by day receiving greater recognition and whose possibilities have not yet been fathomed; secondly, to increase the army of workers and of students." The first number contains the following articles: On electric currents induced by rotating magnets and their application to some phenomena of terrestrial magnetism, A. Schuster; *Die Vertheilung des erdmagnetischen Potentials in Bezug auf beliebige Durchmesser der Erde*, A. Schmidt; and Halley's earliest equal variation chart (with facsimile of photograph), L. A. Bauer. About half of the number is taken up with these, the remainder being devoted to a discussion by F. H. Bigelow and A. Schmidt on the best form for the components of systems of deflecting forces, and shorter notes on old magnetic declinations, by W. van Bemmelen, and some observations of the magnetic inclination in China, by W. Doberck, under the head of letters to the editor, editorials, reviews, etc. It is stated that "all languages that can be printed with Roman characters will be admitted."

EXPERIMENT STATION RECORD.

Vol. VII. No. 9.

The appropriation act for the United States Department of Agriculture for the fiscal year ending June 30, 1897, carries the following general items: For the Office of the Secretary of Agriculture, $94,340; Weather Bureau, $883,772; Bureau of Animal Industry, $729,440, including $12,000 for animal quarantine stations; Agricultural Experiment Stations, $750,000, including $30,000 for the Office of Experiment Stations, with the provision that "the Secretary of Agriculture shall prescribe the form of the annual financial statement required by section three of the Act of March second, eighteen hundred and eighty-seven, shall ascertain whether the expenditures under the appropriation hereby made are in accordance with the provisions of the said Act, and shall make report thereon to Congress;" Nutrition Investigations, $15,000, with provision for coöperation between the Department and the experiment stations; Division of Statistics, $145,160, of which $10,000 "may be expended in continuing the investigations concerning the feasibility of extending the demands of foreign markets for the agricultural products of the United States, and to secure as far as may be a change in the methods of supplying tobacco and other farm products to foreign countries;" Division of Agrostology, $18,100; Division of Biological Survey, $27,560; Division of Botany, $23,800; Division of Chemistry, $29,500; Division of Entomology, $29,500; Division of Forestry, $28,520: Division of Pomology, $12,500; Division of Soils, $15,300; Division of Vegetable Physiology and Pathology, $26,500, "of which so much thereof as may be directed by the Secretary of Agriculture may be applied to the investigation of peach yellows, California grape disease, root rot, and blight of cotton, pear blight, and the diseases of citrus fruits, and the remedies therefor;" Division of Publications, $78,300, of which $50,000 is for Farmers' Bulletins; Document and Folding Room, $7,040; Division of Accounts and Disbursements, $16,300; Library, $7,000; Fiber Investigations, $5,000; Public-Road Inquiries, $8,000; Museum, $5,400; Experimental Gardens and Grounds, $22,500; Furniture cases, repairs, postage, and contingent expenses, $40,000; investigations on water supply by Geological Survey, $4,500 (immediately available); publication of special reports

on Diseases of the Horse and on Diseases of Cattle and Cattle Feeding, $82,500 (to be disbursed by the Public Printer); Division of Seeds, $150,000, "and the Secretary of Agriculture is hereby authorized, empowered, directed, and required to expend the said sum in the purchase, propagation, and distribution of such valuable seeds, bulbs, trees, shrubs, vines, cuttings, and plants, and is authorized, empowered, directed, and required to expend not less than the sum of one hundred and thirty thousand dollars in the purchase at public or private sale of valuable seeds the best he can obtain, and such as shall be suitable for the respective localities to which the same are to be apportioned and in which the same are to be distributed as hereinafter stated, and such seeds so purchased shall include a variety of vegetable and flower seeds suitable for planting and culture in the various sections of the United States.

"That section five hundred and twenty seven of the Revised Statutes be amended so that it will read as follows:

"'SECTION 527. That purchase and distribution of vegetable, field, and flower seeds, plants, shrubs, vines, bulbs, and cuttings shall be of the freshest and best obtainable varieties and adapted to general cultivation.'"

The total amount of the appropriations under this act is $3,255,532. The Divisions of Soils and of Agrostology are for the first time recognized in an appropriation act, and the name of the Division of Ornithology and Mammalogy is changed to the Division of Biological Survey.

THE PATHOLOGY OF PLANTS: LINES OF INVESTIGATION THAT MIGHT BE UNDERTAKEN BY EXPERIMENT STATIONS

B. T. GALLOWAY,

Chief of the Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture.

INTRODUCTION.

The object of this paper is to point out, as clearly and concisely as possible, certain lines of work in plant pathology that might be undertaken by experiment stations. At the outset it must be remembered that the work in question is comparatively new, and that, like other branches of biological science, it is not possible to limit it by hard and fast lines.

It is obvious that pathology, the study of abnormal life processes, must have for its very foundation physiology—the investigation of the normal functions of plants. Plant physiology in its relation to agriculture has received very little attention in this country, and until the importance of this study is recognized we can not hope for the best results in pathology, or in many other lines of work which the experiment stations, by the very act of their creation, are required to pursue. It is recognized that the stations, at least most of them, for the first few years of their existence should devote a large part of their energy to educating the people up to a point where they will be ready to accept and appreciate new principles and facts which may be discovered and advanced. In many localities this has been a difficult task, while in others, owing to the advanced state of agriculture and its kindred branches, the matter has been comparatively easy.

A majority of the stations have now been established nearly ten years, a sufficient length of time, it would seem, to so adjust themselves to existing conditions as to intelligently undertake problems having for their object the discovery and application of new methods and principles in agriculture. After all, it is the discovery of principles and the ability to get them applied that will insure for all time the success of a station.

Although this country has not as yet advanced far toward the discovery of fundamental principles underlying agriculture, the fact remains

that probably nowhere else in the world could work of this kind be undertaken with more certainty of general appreciation and success than here. In comparison with the great mass of agriculturists abroad, our farmers, so far as relates to energy, push, and the ability to grasp new ideas, are superior in every way. When we come to the more intensive grades of agriculture, *i. e.*, fruit growing, truck farming, cultivation of plants under glass, etc., the majority of the growers are really in advance of the stations upon many matters relating to their work. Such being the case, the importance of thorough work and a realization and appreciation of the knowledge already possessed by practical men becomes apparent. We are convinced that the last factor is not fully appreciated by many of our station workers, and in consequence they lose the confidence of the very men who would be the quickest to accept their teachings, provided their own knowledge and long practical experience did not tell them that such teachings were wrong.

The time has come when work done in the laboratory alone, no matter how valuable, will not have its full benefit until carried direct to the farmer and fruit grower in the field and orchard. To accomplish this successfully requires rare ability, for no matter how eminently scientific a man may be, he will fail of his object as a station worker if he can not succeed in interesting the men for whom the stations were established.

As pointed out in a recent number of the Record, a large number of our stations are but poorly equipped for the investigation of comparatively simple problems. Granting, however, that proper facilities are present, and they need not be elaborate, many of the station workers are so loaded down with purely routine duties that they have little time for anything in the nature of new lines of work. It has been well said that "It is essential for the stations to recognize the demand for things immediately useful, and that they find what questions are of direct practical importance and give such questions the proper attention. But it is vitally important that the highest scientific ideal be maintained and every effort be made toward its recognition. The future usefulness of the stations will depend upon what they discover of permanent value, and this must come largely from the most abstract and profound research."

Under the present conditions it is not possible for many of the station workers to undertake such research, and until relieved of some of the routine duties and the necessity for doing work already being done by other stations, little progress can be made. One of the serious drawbacks to advanced research work is this very matter of continued duplication and the running along in the same old grooves year after year. We can not hope to have this difficulty remedied, however, until there is some attempt at unification of purpose or specialization on the part of the stations. There is no well-defined direct

ing organization among the station workers interested in similar lines of investigation. At present every man is in a certain sense left to work out his own destiny in whatever way seems best. Of course all workers recognize the desirability of perfect freedom and independence so far as their investigations are concerned. There is no doubt that work could be made much more effective by the right kind of coöperation looking to an intelligent division of labor and thereby an opportunity to follow out special lines of research leading to the elucidation of problems of a fundamental nature.

It would be useless to make suggestions in regard to such problems without at least pointing out certain pertinent facts which must be considered before the work can be intelligently undertaken. It is in this spirit that the foregoing has been written, and we may now turn to a consideration of the problems themselves, taking up first some of the more general ones, in regard to which it will not be practicable in an article such as this to go into details.

GENERAL PROBLEMS.

It will become apparent upon a little reflection that no plant disease, however simple, can be fully explained upon the theory that only one or perhaps two or three factors are involved. If we could imagine, for example, a disease dependent simply on the mere presence of an organism, the factors involved in destroying or getting rid of the organism would be comparatively few in number. In practice there are no such simple cases, although many of the investigations heretofore made would lead us to believe otherwise. Much of the work done where parasites, including both fungi and insects, are involved has been more or less empirical in its nature, having for its principal object a study of some of the more striking habits of the organism under investigation, without due regard to the surrounding conditions. Such work has unquestionably led to good results in the past, but it seems to us that the time has come when we must go deeper into the subject, for with the advance of knowledge in rural matters and the specialization among those engaged in this work, only the deepest insight into the nature of the problems involved will suffice to explain questions of fundamental importance. Even the diseases which are apparently affected by a comparatively few factors are often found upon investigation to be controlled by a long series of coöperating influences, which if properly understood would throw much light on remedial measures.

Too little attention has been paid to these coöperating influences; in fact to properly understand them requires studies far-reaching in their nature. Nutrition, for example, bears an important relation to many diseases of plants, and it may be well at this point to refer to some of the problems that might be considered by the stations in this connection. Beginning with the soil, we find many problems which as yet have received little notice. For example, a lack of aëration may result

in a weakened growth of roots and a consequent enfeebling of the whole plant. This condition is itself a disease, and often causes death. In other cases the plant in its weakened condition may succumb to the attacks of parasitic or even saprophytic fungi. Again, the disorganization products of decaying roots brought on from lack of aëration often act as direct poisons to the parts above ground. The trouble may not be very marked in many cases, but it may serve to weaken the plant, thus being the first step to many other maladies. A lack of aëration may be the result of poor drainage, improper cultivation, or the texture of the soil. A study of these questions leads into the many unsolved problems of soil physics and chemistry. What changes in texture, if any, do certain fertilizers or combinations of fertilizers bring about? What chemical changes do these fertilizers undergo in the soil, and what changes do they induce in the materials already there? What effect do these physical and chemical changes have on the various crops grown?

The bad effect, for example, of strongly acid or strongly alkaline soils on many crops is well known. Nitrifying organisms do not grow well except in nearly neutral or slightly alkaline soils. This is not all, however. The roots of plants, wholly apart from their relation to nitrifying organisms, often do not grow well in soils of this kind, and the crop is therefore greatly reduced in quality and quantity and is less resistant to disease. On the other hand, there are many parasitic and saprophytic fungi which do grow well under these conditions and are thus able to kill or greatly injure the crops in question. What relation, if any, do these and other soil conditions bear to prevalent diseases, parasitic or otherwise, in any given region?

In the matter of fertilizers it is well known that those giving good results for certain crops on some soils appear to act as direct poisons on the same crop on other soils. Here is a highly important pathological problem, and one that should be carefully worked out. One of the stations has recently carried on some interesting work in this direction, which seems to show that sulphate of ammonia, when used on certain soils, in the absence of sufficient lime, may act as a poison. The functions of lime in this case are not yet wholly clear. The deleterious effects of magnesium salts in the absence of lime has long been a matter of more or less common observation. It has been shown that one use of lime is to unite with free oxalic acid, which often arises in the plants as a secondary product.

O. Loew,[1] by studying the chemical changes produced by oxalic acid in the plant cell, showed that its poisonous action is due to its power of drawing calcium from other combinations, especially from nuclein in the nucleus, and from chloroplasts, in the absence of sufficient free lime. This led him to the discovery that soluble salts of powerful acids, in which the calcium would tend to replace the original base,

[1] Landw. Vers. Stat., 41 (1892), pp. 467–475.

would act in a manner similar to potassium oxalate. This he found true of magnesium salts. The poisonous action of these salts in the absence of lime was like that of oxalic acid and its salts with other bases than calcium. Lime, of course, is the only remedy for this class of poisonous effects.

The effects noted by Loew resemble starvation, and it will be readily seen how in such a case other complications may arise. It is evident that in cases of this kind, where a fungus or other organism is involved, a mere study of the manner of spore production, the germination of spores, etc., will avail but little, as the primary source of the difficulty lies back of these questions. In other words, a study of the effects of environmental conditions on both the parasite and the plant it attacks must be considered.

What are the relations of climate and soil conditions to the growth of the plant? How far do these conditions favor or operate against the development of the plant's parasitic enemies? In what way can these conditions be controlled? These are some of the problems which suggest themselves and upon which little light has as yet been shed.

The practice of irrigating in different regions and on different soils is giving rise to many problems from the standpoint of the plant. It is a well-known fact that plants respond quickly to variations in the amount of water at their disposal.[1] Many of the fruits produced in irrigated regions lack in flavor. Severe root diseases are prevalent in some regions where irrigation is practiced. In some cases they appear to be the result of too much water, bringing on asphyxiation and many secondary complications.

The amount of water and the manner of its use in order to secure the best results for various crops in different soils and regions should be carefully worked out. This should be done not only from the standpoint of the quality and quantity of the product, but also in relation to the various diseases to which the crops in question are subject. To what extent may irrigation or flooding be used as a protection against frost injuries? Do irrigating ditches serve as carriers of noxious fungus and animal pests, such as root rot fungi, nematodes, etc.? In regions not lacking in rainfall to what extent could irrigation be used as a protection against short drought periods, and the injuries resulting therefrom, such as leaf scald, blighting of fruit buds, flowers, etc.?

Aside from these matters, there is another set of interesting phenomena which have an important relation to the other questions discussed, and must be considered in connection with them. These relate to the innate peculiarities or inherent disposition of the plant and its bearing on disease. Such phenomena involve the question of predisposition to disease, immunity, etc., which can not be explained probably until we understand more clearly the effects of environment on the cell

[1]See Water as a Factor in the Growth of Plants, U. S. Dept. Agr. Yearbook, 1894.

itself. This will lead to cytological studies in relation to pathology, a field most promising, but capable of assuming large proportions as will be seen if once we pause to consider the questions involved.

SPECIAL PROBLEMS.

In the preceding pages we have mentioned in a general way some of the more important problems that seem worthy of consideration on the part of station workers. Of course each of these is capable of being developed into almost infinite detail, but this is a matter that must be left largely to the stations themselves. It may be well, however, to cite a few specific lines of work which as yet have received little attention, and which the stations, from the nature of their surroundings, are well qualified to undertake.

Cereal diseases and cereal culture.—The diseases of cereals, especially the rusts, have long been made the subject of study. Despite this fact we have little information of practical importance to the agriculturist, so far as the rusts are concerned. The biology of these parasites is still largely a matter of conjecture, and until many of the doubtful points are settled rational treatment along certain lines that might prove valuable can not be undertaken. It is not yet known how one of the common species, *Puccinia graminis*, perpetuates itself from year to year. Whether it does this through the intervention of some plant other than the barberry, or whether the red rust stage is able to carry it through year after year, are questions not yet determined. It is possible that the fungus may live and propagate itself indefinitely in the warmer sections of the country, advancing north each year as the season advances. Although the rust in question is not nearly so abundant as *Puccinia rubigo vera*, there can be little doubt, as Carleton[1] has pointed out, that it does really all the serious damage in this country. Such being the case, it becomes doubly important to know the full life history of the parasite. Stations especially interested in cereal culture might well coöperate in this work, particularly in the matter of determining how the fungus passes the winter, and whether it spreads, as already suggested, from south to north.

In the matter of remedial measures, it has already been pretty conclusively proved that neither treatments of the seed or soil nor spraying the plants is of any practical value. Attention, therefore, has been turned to the question of rust-resistant varieties, their introduction, and their production by selection and crossbreeding. It is obvious that work of this kind should be accompanied or preceded by investigations which will throw light on the question as to why one variety or strain is more resistant than another. Are there anatomical or physiological differences in the plants that will explain the differences in susceptibility to the disease? What are the relations between host and parasite,

[1]Proceedings of the Society for the Promotion of Agricultural Science, Springfield meeting, 1895.

and in what manner do the conditions of climate and soil affecting the one influence the other? These are difficult questions, and although our present methods of investigation may not enable us to answer them in full, our aim should be to obtain all possible light upon them.

The stations, it would seem, have excellent opportunities in the way of crossbreeding, seed selection, introduction of new varieties, etc. In the matter of crossbreeding, already so successfully carried on at one or two stations, the opportunities for good results are very promising. Varieties adapted to certain localities may be obtained in this way, and even if the crossing is limited to different individuals of the same variety, vigor and hardiness may be increased.

Rational seed selection in connection with this work would doubtless also lead to the most highly beneficial results. No systematic attempt has been made in this or any other country in the matter of improving our varieties of wheats by careful, intelligent, and judicious selection. Of course in this work the question of obtaining rust resistant varieties is not the only one that must be kept in mind. The value of the wheats from a chemical and hygienic standpoint is an important matter, as is also a consideration of the question of developing grains for special food products, viz. bread, macaroni, crackers, etc. In introducing varieties, more attention should be given to studying the conditions existing in the regions from which the grains are obtained and the relation of these conditions to those of certain parts of our own country. What, in other words, are the conditions of soil and climate in certain type wheat regions of this country, and are there similar regions abroad which would likely furnish valuable varieties of grain? Such work would involve coöperative investigation in soil physics, chemistry, and agricultural meteorology, and the exchange of data obtained in this way with foreign countries.

Fungicides and their action on higher plants.—Fungicides have been in more or less extensive use for more than a decade, yet notwithstanding this fact little is known in regard to the direct nature of their action on fungi and their pathological and physiological effects on higher plants. Heretofore the work on this subject has been largely empirical, having for its principal object the destruction of the fungus or its spores, without injury to the treated plant or danger to the health of man or beast. There is no denying the fact that this work, although not based upon very definite scientific knowledge, has resulted in widespread benefit. In view of the progress made along the lines mentioned, it would seem a fitting time to lay aside empiricism and take up a few fundamental problems, which, if thoroughly understood, would throw much needed light on questions of vital interest to both scientific and practical men.

At the present time we have practically but one fungicide in general use, namely, Bordeaux mixture. Many other preparations have been tried, but for various reasons they have been set aside. It is possible

that if the true nature of the difficulties met with were properly understood they could be overcome, and as a result the number of useful compounds would be increased, a desirable consideration, especially as we have not by any means yet reached a state of perfection in this matter.

It hardly seems desirable at this time to cover too much territory, or, in other words, to simply endeavor to make up as large a list as possible of preparations fulfilling the most important qualities of a fungicide. The copper compounds, it would seem, are the most promising, there being very little known as yet in regard to a number of important matters connected with their use. In Bordeaux mixture the chemical and physical properties of the preparation are but imperfectly understood. Mr. W. T. Swingle has recently shown[1] that a consideration of these factors is of great practical importance, and his investigations open up a number of interesting problems. For example, the manner of treating the lime, the impurities in the latter, the method of diluting, and the use of the material warm or cold, all influence the chemistry and physical structure of the preparation. These have a direct bearing on the value of the mixture as a fungicide, affecting its ability to destroy the fungus spores, its adhesiveness, and other important characteristics. The toxic action of the copper compounds on fungi and on the higher plants, however, is the field which so far has received but little attention. Numerous experiments have been made to determine what may be termed the killing strength of these various preparations. It has been shown that the spores of different fungi vary in their susceptibility to the poisonous action of copper. The results along this line, however, are open to doubt in view of the investigations of Nägeli and Cramer[2] upon the oligodynamic action of liquids. It seems altogether probable that work in both this country and abroad to determine the quantity of copper in liquids necessary to kill the spores of fungi may have been wrongly interpreted, owing to the fact made known by Nägeli, that the vessels in which such solutions as were used are kept take up the poisons, and after a considerable time impart these poisons to fresh distilled water placed in them. In view of the fact that this phenomenon was not considered by those engaged upon the work in question, it will be seen that errors were possible. As a starting point, therefore, it would seem desirable to repeat the investigations of Millardet[3] and others under conditions free from the possibility of error on account of the oligodynamic action of the vessels.

In connection with this work it is highly important, both from the standpoint of physiology and pathology, to obtain light upon the

[1] U. S. Dept. Agr., Div. Veg. Phys. and Path. Bull. 9.

[2] Ueber oligodynamische Erscheinungen in lebenden Zellen (Denkschriften der schweizerischen naturforschenden Ges., Bd. XXXIII, 1, 1893).

[3] For the literature on this subject see U. S. Dept. Agr., Div. Veg. Phys. and Path. Bull. 9.

manner in which copper acts as a fungicide, and whether its action is constant or whether it varies with surrounding conditions. In the paper to which reference has been made, Mr. Swingle offers a number of suggestions as to the possible action of copper on fungi. The spores, he says, may be prevented from germinating by inhibitory action—that is, they may not be killed at once, but may be kept from germinating for a sufficient length of time to prevent the plant from being infected. Again, the germ tube may be prevented from entering the plant by negative chemio-tropic action. In such cases the germ tube may not necessarily be injured, but the stimulus to enter the plant, which has been shown to exist by a number of recent workers, would be overcome by the action of the copper. As further possibilities, Mr. Swingle suggests that the germ tubes may be so weakened by the copper as to be unable to enter the host plant, or they may be killed only by coming in contact with solid particles of copper on the leaf, etc. It will be seen that there is yet much to learn in connection with this subject, and many of the points, if settled, would enable us to rationally undertake other lines of work of direct practical importance.

A serious problem which has been met with in connection with the work on fungicides is the effect of the latter on the plant. There is a great deal of contradictory evidence on this matter, and until some definite facts are obtained we can not hope for the best results in treating fungus diseases. The investigation of this subject involves both chemical and physiological work, and possibly can be undertaken by but few of the stations, owing to lack of equipment and men. It seems probable that the injury to foliage and other parts of sprayed plants is due to the presence of soluble copper. In what manner insoluble compounds of this metal are rendered soluble, and therefore injurious, is a question involving many difficulties. The action of the gases of the air may play an important part in the matter. The presence of certain substances in rain and dew must also be considered. Again, substances absorbed from the cells of the leaf itself may prove an important factor; in fact, this is known to be true in certain cases.

The varying action of fungicides as regards their liability to injure the parts of plants treated may be due to differences in metabolic changes arising from variations in environment. This phase of the work is of importance in explaining why a fungicide which is perfectly harmless at one time and place at another time or in some other locality may prove decidedly injurious.

An interesting line of work which has already opened the way to many promising problems is to be found in the effects of some of the fungicides on the treated plants aside from the mere question of the prevention of the attacks of parasites. Bordeaux mixture, as has been shown, has a marked influence on functional activity of plants. Why should the application of such a compound increase the yield in some cases as much as 50 per cent? Or why should the mere fact of spray-

ing with other substances not specially fungicidal in their nature materially sweeten and in other ways modify certain fruits, notably the orange? These are questions which as yet have no solution, and which are of great practical importance to fruit growers and others.

Improvement in apparatus for the application of fungicides.—The wide field which the plant pathologist at the present time is forced to cover is emphasized by the fact that to properly carry out his discoveries in the matter of using remedies for a certain class of plant diseases it is necessary to consider questions for the most part purely mechanical in their nature. Fortunately the importance of spraying is now so well recognized and is coming into such general use that the manufacturing element has been stimulated into an effort to put on the market reliable apparatus that will satisfactorily do the work required. The manufacturer, however, has not yet reached the stage where he is willing to spend much time or money in experimenting with a view of improving the apparatus already in use. Here is an important field for some of the stations, for there is no doubt that our present methods of spraying could be materially improved. Most of the efforts heretofore have been in the direction of getting the various substances on the plants in the most satisfactory manner, to a certain extent regardless of expense.

It is very desirable to reduce the cost of treatment, and this must be accomplished mainly through a reduction in the cost of labor. How to bring this about is a problem that might be legitimately undertaken by the stations. From the present outlook, powders can never prove as successful for fungicides as liquids. It is to the improvement, therefore, of methods of applying the latter that attention should be directed.

As yet but little attention has been given to steam as a means of cheapening the operation of spraying. Steam pumps, it is true, have been used, but no systematic effort has been made to adapt their use to this new line of work. It would seem that the most promising results in this direction might be obtained by using not a steam engine and boiler, but simply a boiler steam pump and steam regulator. Such an apparatus could be made wholly automatic, and the pressure to make a fine mist-like spray could be maintained indefinitely.

The possibilities of improvement in other directions consist largely in pointing out, by means of definite, well planned, and well-described experiments, the various methods and devices that can be adopted for the purpose of saving labor. Where it now costs 12 or 15 cts. to spray a tree, it seems entirely possible to reduce this expense to 8 or 10 cts. How to do this and at the same time maintain the value of the work is, it seems, a legitimate problem for station work.

Studies of the external characters of plant diseases.—Despite the fact that the literature on plant diseases disseminated during the past five years has been considerable, knowledge which will enable practical men

to quickly and easily identify the more common maladies affecting their crops is comparatively limited. Here, it would seem, is an opportunity for work that might be embraced by every station, as no special equipment is required to undertake it and carry it to a successful issue.

The first question which naturally arises in the mind of the farmer or fruit grower when his crop shows signs of sickness is, What ails the plants? No systematic attempt has as yet been made to put information in the hands of the practical man that will enable him to answer the question asked. It seems to us entirely practicable and feasible to describe the more important diseases of plants in such a way that those most directly interested, namely, the growers, would be able to recognize them. It follows naturally that ability to distinguish the diseases will aid materially in assuring successful treatment.

It would hardly seem desirable for all the stations to undertake work of this kind with a view of publishing the results independently, as such a proceeding would of course result in unnecessary duplication of work. Doubtless, operating through the proper channels, a plan of coöperation could be devised that would enable each station to carry on its work independently and in the end obtain the benefit of the labors of all other stations engaged in similar lines of investigation. As a preliminary step to such work it would seem desirable for the stations, by coöperation among themselves, and possibly with the National Department, to get together in convenient form specimens representing as accurately and clearly as possible the principal diseases of the more important crops. This might be effected by a properly organized exchange. Acting under instructions from a central office, specimens representing the various phases of the more important plant diseases might be collected, properly preserved, and forwarded to the exchange. The specimens could be made more valuable by notes on the extent of injury, time of appearance, etc., of the disease. Additional interest in the specimens would result if each were accompanied by a good photograph showing the appearance of the affected plant, or part of the same, while in a perfectly fresh condition. Nearly all the stations are doubtless equipped with cameras and could furnish good prints, of uniform style and size, to accompany the specimens.

By following the foregoing plan it will be seen that each station will eventually build up a good collection, not only of specimens, illustrations, etc., of the diseases in its respective State, but also those which occur elsewhere, and which may possibly need to be guarded against. The importance of proper organization is emphasized here, as without it this as well as other lines of work can not attain the highest success.

RECENT WORK IN AGRICULTURAL SCIENCE.

PHYSICS.

A new method of measuring temperature (*Nature, 53 (1896), No. 1368, p. 211*).—Two thermo-junctions are used, one placed in the substance whose temperature is to be determined, the other in the bulb of an air or nitrogen thermometer. In this bulb is also placed a coil of platinum wire connected with a carbon resistance and a storage battery. In the circuit is also a low resistance galvanometer. The bulb is protected by a sheath of slag wool, asbestus, or metal. "The free thermo junction is placed in the substance whose temperature is to be measured. The galvanometer is immediately deflected. The circuit of the platinum heating coil is then closed, and the carbon resistance screwed down until the galvanometer needle comes back to zero or until making and breaking the thermo-electric circuit produces no movement of the needle. When this is the case, the temperature of the air or nitrogen in the bulb will evidently be the same as that of the substance to be measured and can be directly read off in any of the usual ways on the thermometer."

Professor Röntgen's new discovery (*Chem. News, 73 (1896), No. 1888, p. 19*).

On a new kind of rays (*Chem. Ztg., 20 (1896), No. 6, p. 49*).—A brief note on Rontgen's X rays.

Photography through opaque bodies, A. BROCA (*Rev. Sci., 1896, No. 5, pp. 129–133, figs. 3*).

Photographing through opaque bodies, an interesting application to the study of animals, L. GRANDEAU (*Jour. Agr. Prat., 60 (1896), No. 11, pp. 382, 383, fig. 1*).—An application of the X rays to observe the deposition of the phosphates in the cartilages of the skeletons of young animals

CHEMISTRY.

A systematic study of the organic bases of animal origin (ptomaines, leucomaines, etc.), J. UBEDA (*Mem. Real Acad. Cien. Madrid, 16 (1895), pp. 290*).—The work is an exhaustive compilation of the researches which have been made by others on organic bases which occur in the animal organism, with some original investigations by the author. There are 9 chapters treating of the history of these compounds, methods of preparation, general character, origin and modes

of formation, classification, description, actual experimental work, and bibliography. In so far as it is possible, the compounds are grouped according to their chemical structure. For instance, one group comprises the derivatives of the saturated monatomic alcohols, and another the derivatives of the xanthin bases.

Zinc sulphate as a precipitant for albumoses, A. BÖMER (*Ztschr. analyt. Chem., 34 (1895), No. 5, pp. 562–567*).—The author has successfully used a saturated solution of zinc sulphate in cold water (135 parts in 100) instead of ammonium sulphate for precipitating albumoses, the precipitation being carried out in the same way as is usually done with ammonium sulphate, except that in the case of zinc sulphate 1 cc. of dilute sulphuric acid (1 to 4) is added to prevent the precipitation of phosphates.

The advantages of zinc sulphate over ammonium sulphate are said to be twofold: (1) No ammonia is introduced to be removed before the nitrogen in the albumose precipitate is determined, and (2) the flesh bases, peptones, etc., in the filtrate can be precipitated directly with phospho tungstic acid, which is not possible with ammonium sulphate on account of the precipitation of ammonia by this reagent. An equal volume of the dilute sulphuric acid is added to the filtrate before the phosphotungstic acid.

The results on 4 meat extracts and peptones agree closely by the 2 methods.—B. W. KILGORE.

Contribution to the study of albumose, H. SCHROTTER (*Monat. Chem., 16, p. 609; abs. in Bul. Soc. Chim. Paris, 15–16 (1896), No. 2, p. 204*).—A study of the chemical character of albumose. Albumose differs from peptone in having a higher nitrogen content, a higher molecular weight, and in containing sulphur. A method of estimating the sulphur is given.

On the composition of meat extract, J. KÖNIG and A. BÖMER (*Ztschr. analyt. Chem., 34 (1895), No. 5, pp. 548–562*).—Meat extracts no doubt contain nearly all the constituents of muscular fiber soluble in cold water.

Gelatin can be present only in very small quantities. This view is supported by the work of Beckmann,[1] who found only about 0.5 per cent of albumin and gelatin in Liebig's extract by precipitation with formalin. But Kemmerich[2] found slightly more than 6 per cent gelatin and about 30 per cent of albumoses, peptones, and other soluble nitrogenous substances in South American meat extract. Kemmerich's results were obtained by precipitating gelatin with 50 to 60 per cent alcohol, albumoses with 80 per cent alcohol, and peptones with sodium phosphotungstate.

The authors considered these results high, and repeated the work of Kemmerich and Stutzer. They obtained much lower results than

[1] Hilger's Forsch. über Lebensmittel, 1894, p. 423.
[2] Ztschr. phys. Chem., 1894, p. 409.

Kemmerich, too much so to be due to difference in meat extract used. The filtrate from the precipitate with 80 per cent alcohol gave the biuret reaction, and from this and from comparisons with the results obtained by using ammonium sulphate as a precipitant for albumoses they conclude that 80 per cent alcohol does not remove all the albumoses. They also conclude from their experiments that sodium phosphotungstate precipitates flesh bases and other nitrogenous constituents in addition to peptones and is not a reliable reagent for peptones. They sum up their conclusions as follows: (1) Precipitation with 80 per cent alcohol gives no idea of the kind of nitrogen present; (2) albumoses should be determined by salting out with zinc or ammonium sulphate; (3) the filtrate from the above test should be decolorized by animal charcoal and tested for peptones by the biuret reaction; (4) ammonia determined by distilling with ignited magnesia is of value; (5) when peptones have been shown to be absent, the nitrogen in the phosphotungstate precipitate may be ascribed to flesh bases, after deducting ammoniacal nitrogen and that belonging to gelatin and albumoses. The precipitate should stand at least 1 day.—B. W. KILGORE.

The combination of iodin with potato starch, G. ROUVIER (*Compt. Rend.*, *120* (*1895*), *p. 1179; abs. in Jour. Chem. Soc.*, *68* (*1895*), *p. 586*).—The maximum quantity of iodin with which potato starch will combine is 18.6 per cent, even when the iodin is in excess. For wheat and rice starch the maximum is 19.6 per cent. In the presence of water potato starch combines with only 13.5 per cent, rice and wheat starch with only 8.96 per cent.—W. H. KRUG.

Dextrinon decomposition products of starch, K. BÜLOW (*Pflüger's Arch. Physiol.*, *62*, *p. 131; abs. in Chem. Centbl.*, *1895*, *II*, *p. 919*).—The molecular formula of amylo dextrin was determined by analyzing the barium hydrate compound, and was found to be $(C_6H_{10}O_5)_8$. No definite results were obtained with erythro and achroodextrin, but these seem to have a lower molecular weight than amylodextrin.—W. H. KRUG.

Volumetric estimation of reducing sugars by means of ammoniacal solution of copper hydroxid, Z. PESKA (*Bul. Assn. Chim. Sucr. et Distill.*, *13*, *No. 1*).—The method proposed is as follows: Make a solution of 6.927 gm. of pure copper sulphate in 500 cc. water and add 160 cc. of 25 per cent ammonia water. Dissolve 34.5 gm. Rochelle salt, 10 gm. sodium hydroxid, mix and make up to 500 cc. Keep the solutions separate. Pour 50 cc. of each solution into a beaker and add enough paraffin oil to form a thin layer on the surface of the liquid to prevent oxidation of the reduced copper oxid. Heat to 80 to 85° C. and add juice or solution to be analyzed until the blue color disappears, stirring vigorously meanwhile with the thermometer. The author gives the figures showing the results in the estimation of glucose and invert sugar, which are quite close. It is to be regretted that he does not give also the comparative result, using the ordinary or gravimetric method for estimating reducing sugars.—J. L. BEESON.

Upon the noninfluence of the copper held in the ammonia liquor in the volumetric estimation of glucose by the ammonia-copper method, PELLET (*Bul. Assn. Chim. Sucr. et Distill., 13, No. 3*).—After reviewing the criticisms upon the colorimetric method of Peska, the author mentions the solubility of the reduced cuprous oxid in ammonia, and that it is therefore present in the ammoniacal liquor after titration, but that it imparts no color and can therefore exert no influence upon the accuracy of the analysis. He finds that the point of decoloration is the same with quantities of ammonia which vary considerably, although the larger the quantity of ammonia in the liquid the more of the colorless cuprous oxid will be dissolved. By adding 2 cc. of ammonia water to 5 cc. of Fehling's solution and titrating to the disappearance of the color he obtained the same results as in ordinary titration without ammonia. The author emphasizes the fact that the above method when well in hand is accurate enough for all ordinary purposes; and for the most accurate work, as in the case of investigations, he recommends Peska's original method. In order to prevent oxidation of the reduced copper oxid he suggests making the titration in a small flask or test tube instead of a casserole or beaker.—J. L. BEESON.

Estimation of glucose in the presence of ammonia by the cupro-potassic liquor, ZAMARON (*Bul. Assn. Chim. Sucr. et Distill., 13, No. 1*).—The author finds it difficult to get accurate results with the above colorimetric method in the presence of subacetate of lead, but upon removing the lead, which he does with ammonium oxalate, the method gives most exact results. He tried the titration in the presence of varying amounts of ammonia, always with the same results. His work confirmed that of Peska and Pellet except in regard to the presence of the acetate of lead.—J. L. BEESON.

Isomaltose, E. JALOWETZ (*Mitt. oesterr. Vers. Stat. und Akad. f. Brauind. Wien; Chem. Ztg., 19 (1895), No. 89, p. 2003*).—Experiments with mixtures of maltose and dextrin showed that it was impossible to obtain a pure maltosazone, and that the crystalline form and melting point of the product varied with the amounts of maltose and dextrin used. The results are further proof of the nonexistence of Lintner's isomaltose.—W. H. KRUG.

Glucose acetone, E. FISCHER (*Ber. deut. chem. Ges., 28 (1895), p. 2496; abs. in Chem. Ztg., 19 (1895), No. 92, Repert., p. 317; and Neue Ztschr. Rübenz. Ind., 35 (1895), No. 23, p. 251*).—Dextrose, arabinose, and fructose combine with 2 molecules acetone under the influence of dilute hydrochloric acid and shamnose with 1 molecule. The compound of dextrose with 1 molecule of acetone has also been prepared. Although the method of formation of these compounds corresponds to that of the alcohol glucosids, a different structured formula must be assigned to them on account of their indifference to emulsin and the yeast enzyms.—W. H. KRUG.

Glucose semicarbazid, A. and W. HERZFELD (*Ztschr. Ver. Rübenz. Ind. deut. Reich., 1895, p. 853*).—When glucose and semicarbazid are heated to 100° for several hours a crystalline substance, almost insoluble in absolute alcohol but easily soluble in water, is formed. Its constitution has not yet been definitely determined.—W. H. KRUG.

The oxidation of complex carbohydrates, G. DE CHALMOT (*Amer. Chem. Jour., 17 (1895), p. 535*).—When sodium hydrate and bromin act on starch a product is obtained which reduces Fehling's solution in the cold; cellulose similarly treated gives an oxycellulose which reduces Fehling's solution at 100°. The products from saccharose and α-methyl-δ-glucosid gave a glucosazone and an osazone either of α-methyl-δ-glucosid or δ-glucose.—W. H. KRUG.

The action of dilute alkalies on carbohydrates, C. A. LOBRY DE BRUYN (*Rec. trav. Chim. Pays-Bas., 1895, p. 156; abs. in Chem. Ztg., 19 (1895), No. 102, Repert., p. 403*).—Dilute alkalies reduce the rotatory power of the sugars almost to 0°. Ammonia, barium, and calcium hydrates act similarly but not as rapidly. This phenomenon has nothing in common with multirotation, and may be an intermediary reaction in the conversion of dextrose into saccharic acid.—W. H. KRUG.

A characteristic reaction for cane sugar, M. G. POPASOGLI (*Abs. in Bul. Assn. Chim. Sucr. et Distill., 13, No. 1*).—When to an aqueous solution of sucrose (10 to 20 per cent) 0.5 cc. of a 5 per cent solution of a cobalt salt is added, and then 5 cc. of a 50 per cent caustic soda solution, there is immediately developed a beautiful amethyst violet color which is permanent. If the test be repeated, using glucose instead of cane sugar, a blue coloration is obtained which soon changes to a dirty greenish hue far less intense than the violet color in the preceding test. The difference in color serves to distinguish with certainty between the 2 sugars and for the detection of adulteration of commercial articles by either of them. The author tried the test in both aqueous and alcoholic solutions of cane and glucose sugars with success. If glucose and sucrose are both present in the same solution, the presence of the sucrose is revealed up to the point where there is 9 times the quantity of glucose present. [The reviewer has repeated these tests and finds that a small quantity of sucrose present with a large quantity of glucose gives the characteristic blue color for glucose when seen in reflected light, but viewed at arm's length by transmitted light shows the violet color of the sucrose reaction. A very small quantity of sucrose in the glucose may be thus detected. If the products to be examined are colored, clarify with subacetate of lead or boneblack.]

Cane sugar added to sweet wines or to condensed milk may thus be detected. Honey gives with the test a blue color which passes almost immediately into pale green; and lactose gives a transient blue color. If dextrin or gum arabic be present they must be removed, the former with barium hydroxid, the latter with subacetate of lead, as they develop colors which obscure the glucose and sucrose reactions.—J. L. BEESON.

The formation of glucic acid by the action of calcium hydroxid upon glucose or invert sugar, H. WINTER (*Bul. Assn. Chim. Sucr. et Distill., 13, No. 1*).—Upon warming a 1 per cent solution of glucose or invert sugar with a ½ per cent solution of limewater at 66.5° C. there is formed a voluminous white flocculent precipitate, which redissolves at a higher temperature. On account of the ease with which the precipitate is oxidized it must be washed by decantation, preferably with limewater, in which it is less soluble than in water. The precipitate which he believes to be a lime salt was decomposed with sulphuric acid and extracted with ether. Upon evaporating the ether a crop of clear, needle-shaped crystals was obtained, which the author identified as glucic acid. By concentrating the mother liquor in a desiccator over sulphuric acid similar crystals were obtained. The glucic acid gradually but completely decomposed into carbon dioxid, apoglucic, formic, and other acids.—J. L. BEESON.

Rapid method of estimating dry matter, sucrose, and purity in molasses and masse cuites, J. WEISBERG (*Jour. Fabr. Sucr., 1895, Aug. 11*).—The method requires only 1 weighing, 1 polarization, and 2 calculations, and is as follows: Dissolve 5½ times the normal weight of the sample (=65.12 gm.), and make up to 250 cc. Estimate solids by Brix spindle (say 18.8). Polarize 50 cc. corresponding to one-half normal sugar weight; reading × 2 = per cent of sucrose (say 44.2). Calculate the percentage of sucrose in solution (instead of polarizing a normal weight) as follows: 44.2×0.26048 (weight of sucrose corresponding to 1 per cent on the sucrose scale) ÷1.078 (specific gravity corresponding to the 18.8 Brix) =10.68 per cent of sucrose in the liquid. Solids 18.8÷10.68 sucrose =56.8 purity coefficient. Calculate solids in the sample as follows: $\frac{44.2\times100}{56.8}=77.8$ total solids in sample. Hence we have the following as the analysis of the sample:

	Per cent
Total solids by Brix	77.8
Sucrose (by actual polarization)	44.2
Nonsugars	33.6
Purity coefficients	56.8

The method is much shorter than the one generally followed.—J. L. BEESON.

The estimation of phosphoric acid by titration of the yellow precipitate of ammonium phosphomolybdate, B. W. KILGORE (*North Carolina Sta. Bul. 119, pp. 259-278*).—After very thorough tests by the author and others of various modifications of this method, the results of which are given in the bulletin, the following is recommended as having given "most excellent" results:

"Weigh 2 gm. of substance and make solution by one of the following methods: (1) Evaporate with 5 cc. of magnesium nitrate solution, ignite, and dissolve in hydrochloric acid. This is for organic materials. (2) Dissolve in 30 cc. of concentrated nitric acid with a small quantity of hydrochloric acid. (3) Add 30 cc. concen-

trated hydrochloric acid, heat, and add cautiously in small quantities at a time about 0.5 gm. of finely pulverized potassium chlorate. These (2 and 3) are for ordinary phosphates and fertilizers. (4) Dissolve in 15 to 30 cc. of strong hydrochloric acid and 5 to 10 cc. of nitric acid. This is for phosphates containing much iron and aluminum. Method 2 is preferred when these acids are a suitable solvent for the material. Make up to 200 cc. (or any other convenient volume), measure out 20 cc. for total phosphoric acid, or for percentages above 5 or 6; and 40 cc. for insoluble phosphoric acid, or for percentages below 5 or 6, corresponding to 0.2 and 0.4 gm. substance, respectively; add about 5 cc. concentrated nitric acid, when method 2 for solution has been used, and about 10 cc. when method 1, 3, or 4 has been used. Now add ammonia until precipitate just begins to form, dilute the high percentage solutions to about 100 cc. and low percentage ones to 60 or 75 cc., digest in water bath at 60 to 65° C., and after filtering the molybdic solution to be used in this method, precipitate, not using any greater excess of molybdic solution than is necessary to insure complete precipitation; let stand in bath 6 minutes from the time the molybdate is added, and filter as quickly as possible upon a 3-inch Hirsch funnel, whose perforations are covered with a disk of soft filter paper, or in a Gooch crucible with 1 or 2 pieces of filter paper, slightly larger than the bottom of the crucible, tightly pressed against it, or upon a filter made by using a platinum cone or disk well filled with holes in a 3-inch funnel and covering with coarse asbestus, using the pump in all cases. Filter paper may be used, but the other filters in the order named are much to be preferred. It is especially urged that the 3-inch Hirsch funnel be used where possible, as it permits of rapid filtration and easy and thorough washing. Wash the precipitate twice by decantation with dilute nitric acid, using 50 to 75 cc. each time and agitating thoroughly, once by decantation with the same amount of 3 per cent potassium or ammonium nitrate, then on to the filter and with 200 to 500 cc. water (250 cc. is usually enough), or until no longer acid. Now wash the precipitate with filter back into the beaker, titrate with potassium and hydroxid and back with nitric acid, using phenolphthalein as indicator and adding acid until color disappears.

"In washing by decantation, if the precipitate is allowed to settle completely each time, no trouble will be experienced in the after washing. Where the phosphoric acid is below 1 per cent the precipitation is not so rapid as in larger percentages and may require 8 or even 10 minutes to be complete."

The estimation of phosphoric acid in soils by double precipitation with molybdic solution, and titration of the ammonium phosphomolybdate with standard alkali,[1] C. B. WILLIAMS (*North Carolina Sta. Bul. 119, pp. 279, 280*).—Results of tests are reported which indicate that the difficulties encountered in determining small amounts of phosphoric acid in soil extracts may be overcome by the use of the following method:

"Destroy all organic matter in the hydrochloric acid extract, as well as in the organic acids extracts. This is done in the former case by adding about 1 cc. concentrated nitric acid for every 3 cc. of the portion taken for analysis, and evaporating to 2 or 3 cc. concentration, and in the latter cases, by evaporating the extracts to dryness, and igniting with the addition of a small quantity of nitric acid, until organic matter is completely destroyed. These residues are now dissolved up to convenient volumes, and portions corresponding to 18 or 20 or more grams of soil, and portions of the hydrochloric acid extract corresponding to one or more grams of soil (according to the richness in phosphoric acid) are taken and, after adding about 15 gm. ammonium nitrate, are precipitated with a large excess of molybdic solution (30 cc. is usually enough). Let stand 4 hours, filter, and wash with water twice. . . .

[1] See also Jour. Amer. Chem. Soc., 17 (1895), No. 12, pp. 925, 926.

"Now dissolve the precipitate with dilute ammonia into the beaker used for precipitation, wash the filter with dilute nitric acid, and add concentrated nitric acid until precipitate begins to reform; add 10 gm. ammonium nitrate, digest in water bath at 65° C., add 2 cc. strong nitric acid with vigorous stirring; let stand 5 minutes, add 2 cc. molybdic solution, and let stand 8 minutes more; filter, wash, and titrate according to the volumetric method used in this laboratory." [See above.]

The reagents to be used are prepared as follows:

"*Molybdic solution.*—Dissolve 100 gm. of molybdic acid in 400 gm., or 417 cc., of ammonia, sp. gr. 0.96, and pour the solution thus obtained into 1,500 gm., or 1,250 cc., of nitric acid, sp. gr. 1.20, and add 80 cc. nitric acid, sp. gr. 1.42. Or to each 100 cc. of the official molybdic solution (the above formula without the 80 cc. nitric acid) add 5 cc. nitric acid 1.42 sp. gr. This solution should be filtered each time before using.

"*Dilute nitric acid wash.*—Dilute 100 cc. of 1.42 sp. gr. nitric acid to 1,000 cc.

"*Potassium or ammonium nitrate wash.*—Dissolve 3 gm. of either in 100 cc. of water.

"*Alcoholic solution of phenolphthalein.*—100 cc. to 1 gm.

"*Standard potassium hydroxid.*—This solution should contain 18.17106 gm. potassium hydroxid to the liter. One cc. of this solution equals 1 mg. P_2O_5 (1 per cent P_2O_5 on basis of 0.1 gm. substance), and 100 cc. will neutralize 32.38 cc. normal acid, and can be made by diluting 323.81 cc. of normal potassium hydroxid (which has been freed from carbonates by barium hydroxid) to 1,000 cc.

"*Standard nitric acid*, of the same strength, or one-half the strength of alkali. Hydrochloric or sulphuric acids will answer."

A new method of determining potash, P. LÖSCHE (*Chem. Ztg.*, *20* (*1896*), *No. 5, pp. 38, 39*).—This method, which was worked out by Mehns, of Stassfurt, is as follows: Boil 50 gm. of the finely ground sample in a 200 cc. flask with 150 cc. of water and 10 cc. of concentrated hydrochloric acid. When solution is complete cool and fill the flask to the mark. Transfer 10 cc. of the solution to a porcelain dish and add a little more than enough platinic chlorid to precipitate the potash present. Evaporate to dryness, grind the residue with a glass pestle, stir up several times with 96 per cent alcohol, and throw onto a dried and weighed filter. Remove impurities by washing the precipitate with ammonium chlorid solution heated to 30° C. Wash finally with 96 per cent alcohol, dry, and weigh. The method is applied to sulphate without modification, it being claimed that the washing with ammonium chlorid solution transforms all the potash into K_2PtCl_6.

Recently H. Haefcke has severely criticised the above method.[1] He points out that substantially the same method has already been proposed by De Roode.[2] It is maintained that washing with ammonium chlorid solution, which was first proposed by Finkener,[3] introduces an error, as Finkener has himself pointed out, by dissolving some of the double salt. It is also denied that when sulphates are present the potash is completely transformed into K_2PtCl_6, as claimed by Lösche.

The preparation of perchloric acid and its application to the determination of potassium, D. A. KREIDER (*Chem. News*, *73* (*1896*),

[1] Chem. Ztg., 20 (1896), No. 11, pp. 88, 89.
[2] Jour. Amer. Chem. Soc., 17 (1895), p. 85 (E. S. R., 6, p. 867).
[3] Pog. Ann., 29 (1867), p. 85.

No. 1885, p. 17).—This article is continued from the preceding number of *Chemical News*, the first portion dealing with the preparation of perchloric acid. The author has obtained very satisfactory results in the estimation of potassium by converting into the perchlorate by the method suggested by Caspari.

The method is as follows: The substance, free from sulphuric acid, is evaporated to expel free hydrochloric acid, the residue stirred with 20 cc. of hot water, and then treated with perchloric acid in quantity $1\frac{1}{2}$ times that required by the bases present. The mixture is evaporated with frequent stirring to a thick sirup-like consistency, again dissolved in hot water, and evaporated as before till all the hydrochloric acid has been expelled and the fumes of perchloric acid appear. Further loss of perchloric acid is to be compensated for by the addition of more. The cooled mass is stirred with about 20 cc. of 97 per cent alcohol containing 0.2 per cent by weight of perchloric acid, without breaking crystals to too fine powder. This is decanted onto an asbestus filter and the operation repeated. The alcohol is evaporated from the residue in the dish, and the residue dissolved in 10 cc. of hot water and a little perchloric acid. This is now evaporated as before till the fumes of perchloric acid arise, when it is washed with 1 cc. of the alcohol mixture, transferred to the asbestus filter, preferably by means of a rubber-tipped stirring rod, to avoid the use of too much alcohol, and finally covered with pure alcohol. It is dried at 130° C. and weighed as $KClO_4$.

Sulphuric acid must first be removed. When phosphoric acid is present, a portion always remains with the potassium perchlorate unless great care is taken and a large excess of perchloric acid is used. The results by this method on potassium chlorid were good, but when other bases were present the results were not so satisfactory.—B. W. KILGORE.

Notes upon the determination of nitrites in potable water, A. H. GILL and H. A. RICHARDSON (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, pp. 21-25*).—In comparing the results obtained by Trommsdorff's iodo zinc starch method and Griess's α-naphthylamine test, discrepancies occurred which were especially marked with peaty waters. To obviate this the authors decolorized the waters by shaking 250 cc. of water with 3 cc. of "milk of alumina," allowing it to settle and filtering through a nitrite-free filter.—H. J. PATTERSON.

The solution of cellulose by enzym (cytase), J. GRÜSS (*Wochenschr. Brauerei, 12 (1895), p. 1259; abs. in Chem. Ztg., 20 (1896), No. 16, Repert., p. 48*).

Note on the Mann, Krüger, and Tollens process of determining pentoses and pentosans by furfurol distillation, B. TOLLENS (*Ztschr. angew. Chem., 1896, No. 7, pp. 194, 195*).

Apparatus and method of estimating the dry matter in sugar products, WEISBERG (*Bul. Assn. Chim. Sucr. et Distill., 12, No. 11*).—The author describes an apparatus for drying the products by driving dried air through a flask heated to 100° C. in a water bath until a constant weight is obtained.—J. L. BEESON.

Influence of the lead precipitate upon the sucrose readings in cane sugar, J. D. MOORE (*Abs. in Bul. Assn. Chim. Sucr. et Distill., 12, No. 7*).—In the case of masse cuites he finds the error in the sucrose reading to be on an average 0.99 per cent,

minimum 0.785, and maximum 1.187 per cent. In the case of molasses the minimum error is 1.062, maximum 1.189, and average 1.112 per cent.—J. L. BEESON.

On the chemical composition of pepper, F. E. BAUER and A. HILGER (*Forsch. ü. Lebensmtl und Hyg. Chem., 3 (1896), No. 4, pp. 113–127*).—A chemical study of the subject with a view to determining adulteration with hulls.

The analysis of indigo, E. C. KEYSER (*Indian Agr., 21 (1896), No. 3, p. 85*).—The method is given in detail.

On the microscopic inspection of flour, LANGE (*Ztschr. angew. Mikr., 1 (1896), No. 12, pp. 369, 370*).

Rapid method of testing flour for quality, O. CAMPION (*Ann. Pharm., 1896, p. 10; abs. in Chem. Ztg., 20 (1896), No. 22, Repert., p. 66*).

Estimation of boric acid in milk, R. T. THOMSON (*Glasgow City Anal. Soc. Rpt. 1895, p. 3; abs. in Analyst, 21 (1896), Mar., p. 64*).

The elimination of ammonium sulphid in methods of quantitative analysis, N. TARUGI (*Gaz. chim. Ital., 25, pp. 478–481; abs. Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 8, pp. 670, 671*).

Analysis of slag by Wagner's method (*L'Engrais, 11 (1896), No. 13, pp. 304, 305*).

A source of error in the determination of phosphoric acid by the citrate method, F. BERGAMI (*Jour. Frank. Inst., 141 (1896), No. 5, pp. 384–385*).—In a series of experiments too high results were obtained when the filtration of the ammonium magnesia phosphate was delayed more than 3 hours, in all cases except in the determination of soluble phosphoric acid.

Remarks on the Leopoldshall Stassfurt method of determining potash, R. KUBE (*Chem. Ztg., 20 (1896), No. 27, p. 270*).—Experiments with pure potassium chlorid indicate that drying the double salt at 130° C. for $\frac{1}{2}$ hour and assuming $KCl = K_2PtCl_6 \times .3056$ gives results about $\frac{1}{4}$ per cent too high. One-half hour's drying at 130° C., using the factor .301, or 12 hours' drying, using the first factor, gave correct results.

Determination of potash as potassium platinic chlorid, E. BAUER (*Chem. Ztg., 20 (1896), No. 27, p. 270*).—The author dissolves the washed double salt in 80 to 90 cc. of hot water on the filter, evaporates the solution to dryness, and weighs the residue.

Standardizing of normal acid by borax, F. BERGAMI (*Jour. Frank. Inst., 141 (1896), No. 5, p. 386*).—Titration with a solution of chemically pure borax purified by double crystallization, using lacmoid as an indicator, as proposed by R. T. Thomson (*Chem. News, 61, p. 18*) is recommended.

Water analysis, J. A. WANKLYN and E. T. CHAPMAN (*London: Kegan, Paul, French, Trubner & Co., 1896, 10th ed., pp. 200*).—Revised and partially rewritten.

On the volumetric determination of lead, A. S. CUSHMAN and J. H. CAMPBELL (*Jour. Amer. Chem. Soc., 17 (1895), No. 11, pp. 901–904*).—The method proposed is a modification of that of Schwartz, and consists in filtering off the precipitated lead chromate and determining the excess of the bichromate by means of a standard solution of ammonium ferrous sulphate, using potassium ferricyanid as an indicator. Tables give results of comparisons of methods.—H. J. PATTERSON.

Note on a convenient form of polarimeter for examining essential oils, E. R. BUDDEN (*Analyst, 21 (1896), No. 238, p. 14*).

New laboratory apparatus, KAEHLER and MARTINI (*Ztschr. angew. Chem., 1896, No. 7, p. 195, figs. 3*).—Apparatus for determining the melting point of fats, etc., for bromination and chlorination and a beaker of modified Erlenmeyer form with lip

Work of the provincial laboratory of Roulers, West Flanders, in 1894 (*Rap. Trav. Lab. Roulers, 1894, pp. 16, pls. 3*).—This report gives a summary of the work of the year, including analyses of a large number of samples of fertilizers, fodder beets, and artesian waters, and a description of a new seed germinator.

Report of work at the State laboratory at Antwerp in 1894, D. CRISPO (*Rap. Trav. Lab. Etat Anvers, 1894, pp. 23*).—This includes tabulated analyses of fertilizers and food accessories (chicory and coffee) and records of tests of sugar-beet seed, with comments on special analyses.

Hawaiian experiment station and laboratories, W. MAXWELL and J. T. CRAWLEY (*Rpts. Expt. Sta. and Lab. Hawaii, 1895, pp. 46*).—This is the first report of these institutions, which were established by the Hawaiian Sugar Planters' Association, and includes short articles on soils, fertilizers, and fermentation of sugars.

Annual convention of the Association of Swiss Analytical Chemists in Neufchatel, September 27, 28, 1895 (*Chem. Ztg., 19 (1895), No. 84, pp. 1895–1899*).

BOTANY.

The favorable influence of low temperatures on the viability of fungus spores, J. ERIKSSON (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 216–223*).—The author examined the germinative power of a number of different varieties of grain rusts at ordinary and at low temperatures, and noticed that low temperatures exercised a marked influence in increasing germination. The spores were kept in water at ordinary room temperature, on ice, or in ice water on dishes placed in a freezing oven, especially arranged for these experiments. The temperature in the oven could be lowered to about 10° F.

It was found that a perceptible increase in viability was noticeable in *Æcidium berberidis* in 7 out of 12 trials at slight cooling (not below 0° C.), and in 4 out of 5 cases at strong cooling (below 0° C.); in *Peridermium strobi* in all 5 cases at slight cooling; in *Uredo glumarum* in 5 out of 8 cases at slight cooling, and in 4 trials at a considerable reduction of the temperature. Since cooled spores germinated more rapidly, this increase was more apparent than real, the totals being no greater. In *Uredo coronata* in 1 out of 2 trials at lower temperature germination was hastened.

A long continued extremely low temperature was found to be deleterious; the germination in some trials did not seem to be influenced by the low temperature. The author quotes from scientific literature observations suggesting the presence of a stimulating effect of cold temperatures on lower plant life.—F. W. WOLL.

Contributions to the knowledge of indigenous fungi, II, C. WEHMER (*Jena: G. Fischer, 1895, pp. 184, pls. 3*).—The titles of the several articles grouped together in this number of the contributions are: (1) Investigations concerning the rotting of fruit; (2) on the unequal physiological action of fumaric and maleic acids and the antiseptic action of the latter; (3) the nutritive value of sodium salts for fungi; (4) on the preference of fungi for certain organic acids; (5) on the significance of iron combinations for fungi; and (6) on the occurrence of fungi and some notes upon the fungus flora of the German North Sea islands.

A study of the action of different rays of the solar spectrum on vegetation, C. FLAMMARION (*Compt. Rend., 121 (1895), No. 25, pp. 957–961, fig. 1*).—The author compared the growth of plants under light from red, green, and blue glass with growth of those under the same meteorological conditions except that the glass was clear. The sensi-

tive plant was the principal subject of the experiment, but the results were in the main confirmed upon geranium, strawberry, and pansy plants. The results obtained showed the greatest growth in height for the plants grown under the red, green, white, and blue glass in the order named. For vigorous growth and active vegetation the order was red, white, green, and blue. The results as given by the author are confirmed in part by A. Gautier, who reports briefly the results of 12 years' experiments in the same line. The latter author states that his plants, Leguminosæ, Iris, and Ranunculaceæ, grew best under red light, were less well developed under yellow, became etiolated under violet, and died under green glass.

The rôles of philothion and of laccase in the germination of seed, J. DE REY-PAILHADE (*Compt. Rend.*, *121* (*1895*), *No. 27*, *pp. 1162–1164*).—These 2 substances, which are said to possess opposite chemical properties, have been examined by the author. He found them both present in the seed of beans, chickpeas, ordinary peas, white lupine, kidney bean, soja bean, wheat, maize, chestnut, horse chestnut, maple, and gingko. The piñon pine contained philothion, but no laccase. Laccase was found in castor bean, radish, squash, nightshade, convolvulus, and tubers of potato, but little or no philothion; while acorns and laurel seed contained neither.

In seed containing laccase this substance is present before absorption is begun, and it increases with the period of the germination. The philothion is present only in very small quantity in the dry seed, but becomes more abundant when the tissues are swollen with water.

Laccase seems to be an agent for inducing the oxidation of the oxidizable substances of the seed. This is shown by the oxidation of the philothion within 4 or 5 hours under the combined action of laccase and oxygen. In the presence of laccase alone there is no change; while in oxygen without laccase the oxidation of philothion takes place very slowly. From this it appears that, under the influence of laccase, philothion combines very rapidly with the free oxygen, producing carbon dioxid, and thus hastens germination.

The reserve materials of plants, J. R. GREEN (*Jour. Roy. Agl. Soc. England*, *ser. 3*, *6* (*1895*), *No. 24*, *pp. 635–656*, *figs. 18*).—The author discusses the subject of the reserve material of plants under the following heads: Mode of nutrition of plants; reservoirs of food, their position; construction of nutritive substances; and the storage of surplus manufactured material—(*a*) temporary storage; (*b*) more permanent stores, as carbohydrates, proteids, and oil.

Cane sugar in plants, SCHULZE and FRANKFURT (*Ztschr. physiol. Chem.*, *20*, *p. 511*; *21*, *p. 108*; *abs. in Jour. Chem. Soc.*, *68* (*1895*), *p. 523*).—Sucrose is not only a valuable reserve material but also plays an important rôle as a circulating form of starch. Other soluble forms of carbohydrates are almost always present, but these are probably only reserve stuffs and are ultimately changed into sucrose.—W. H. KRUG.

On the morphology and development of the genera of the section Stellatæ of the Rubiaceæ, M. FRANKE (*Bot. Ztg., 54 (1896), No. 3, pp. 33-60, pl. 1*).

Reproduction and fertilization in Cystopus candidus, H. WAGER (*Ann. Bot., 10 (1896), No. 37, pp. 89-91*).

Concerning extratropical epiphytes, R. BEYER (*Abhandl. bot. Vereins, Brandenburg, 32 (1895), p. 105; abs. in Naturw. Rundschau, 11 (1896), No. 5, pp. 58-60*).

New or critical fungi, G. MASSEE (*Jour. Bot. England, 34 (1896), No. 400, pp. 145-154, pl. 1*).

New North American grasses, F. LAMSON-SCRIBNER (*Bot. Gaz., 21 (1896), No. 3, pp. 133-139, pls. 3*).—Descriptions are given of the following new species: *Avena mortoniana, Danthonia parryi, Zeugites smilacifolia*, and *Pringleochloa stolonifera*. The last named genus is also new.

New Kansas fungi, J. B. ELLIS and E. BARTHOLOMEW (*Erythea, 4 (1896), Nos. 1, pp. 1-4; 2, pp. 23-29*).—Descriptions of 36 new species of fungi are given.

Australian fungi, D. MCALPINE and L. RODWAY (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, pp. 84-87, pl. 1*).—Notes are given of a number of species of fungi, 3 of which are new to science. The new species are *Clavaria phyllophila, Sclerotinia dubia*, and *Hydnocystis convoluta*.

Studies of the Discomycetes, C. STARBÄCK (*Bihang. Svensk. Vetensk.-Akad., Handlingar, 21 (1895), No. 5, pp. 42, pls. 2*).

Studies on the Saprolegniæ, A. MAURIZIO (*Flora, 82 (1896), pp. 14-31, pl. 1*).

On the structure and character of the cell, WALDEYER (*Deut. med. Wochenschr., 1895, No. 43-44; abs. in Bot. Centbl., 65 (1896), No. 10, pp. 339-343, fig. 1*).

The constituents of the cell walls of the cotyledons of Lupinus luteus and L. angustifolius and their relation to germination processes, E. SCHULZE (*Ber. deut. bot. Ges., 14 (1896), No. 2, pp. 66-71*).

Nuclear division without cell division, J. LOEB (*Arch. Entwickel. Organ., 2 (1895), No. 2, pp. 298-300; abs. in Bot. Centbl., 65 (1896), No. 5, p. 175*).

The nucleus and nuclear bodies in meristematic tissues, F. ROSEN (*Cohn's Beiträge Biol. Pflanzen, 7 (1895), pp. 225-312, pls. 3; abs. in Bot. Centbl., 65 (1896), No. 4, pp. 115-117*).

On nuclear division and spore formation in the ascus, R. A. HARPER (*Ber. deut. bot. Ges., 13 (1896), Generalversammlungs No., pp. 67-78, pl. 1*).

Concerning the physiology and morphology of angiosperm ovules, M. WESTERMAIER (*Ber. deut. bot. Ges., 14 (1896), No. 1, pp. 33-35*).

On the development of the seed in the Scitamineæ, J. E. HUMPHREY (*Ann. Bot., 10 (1896), No. 37, pp. 1-40, pls. 4*).

On the modification of stems and roots for the purposes of respiration, H. VON SCHRENK (*Trans. Amer. Micr. Soc., 1896, pp. 13, pls. 3*).

Comparative morphology and anatomy of the cotyledons and first leaves of monocot seedlings, A. SCHLICKUM (*Bibliotheca Botanica, 1896, No. 35, pp. 88, pls. 5*).

Contributions to the morphology of budding fungi, S. EISENSCHITZ (*Inaug. Diss. Bern, 1895, pp. 24; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 2-4*).—Studies were made of *Saccharomyces apiculatus, S. cerevisia, S. glutinis, S. pastorianus, S. kefir*, and *Mycoderma vini*.

The course of the fibers through wound tissue, C. MÄULE (*Bibliotheca Botanica, 1895, No. 33, pp. 32; abs. in Bot. Ztg., 54 (1896), II, No. 6, pp. 89-91*).

The explanation of the flowers of the Cruciferæ and Fumariaceæ according to their anatomy, O. LIGNIER (*Compt. Rend., 122 (1896), Nos. 10, pp. 630-632; 11, pp. 675-678*).

On the anatomical structure and the form of the haustoria of Lathræa squamaria and L. clandestina, E. HEINRICHER (*Cohn's Beiträge Biol. Pflanzen, 7, pp. 315-406, pls. 6; abs. in Bot. Ztg., 54 (1896), II, No. 6, pp. 85-87*).

The assimilation of lecithins by plants, J. STOCKLASA (*Abs. in Naturwiss. Rundschau, 11 (1896), No. 13, p. 165*).—The author states that this is the first recorded case

of the assimilation of phosphorus from an organic compound, although the results obtained were not as successful as when the phosphorus was applied in an inorganic form.

On the presence of solanin in potatoes and its formation during sprouting, G. MEYER (*Arch. exptl. Path. und Pharm., 36 (1895), No. 5–6, pp. 361–372; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 62, 63*).—This substance is least abundant in the fresh sound tubers and is most abundant when sprouting has begun. Sprouts 1 cm. long have 5.03 parts per thousand of solanin as compared with 0.800 parts when 15 cm. long.

Are the leaves of Primula obconica poisonous? W. T. RAMBUSCH (*Amer. Gard., 17 (1896), No. 67, p. 215*).—Brief note stating that eruptions and itchings follow handling this plant.

The function of osmosis in vegetation and the accumulation of sugar in sugar beets, L. MAQUENNE (*Ann. Agron., 22 (1896), No. 1, pp. 5–20*).

Salt and sugar content of Washingtonia filamentosa, H. TRIMBLE (*Garden and Forest, 9 (1896), No. 432, pp. 133, 134*).—The author, while examining a trunk of this palm for tannin, which was present in small quantity, found 15.5 per cent dry weight of sugar, probably a glucose sugar, and 3.09 per cent sodium chlorid. The specimen was from Santa Barbara, California.

The tannins of fungi, O. NAUMANN (*Inaug. Diss. Erlangen, 1895, pp. 18; abs. in Bot. Centbl., 65 (1896), No. 8, pp. 254, 255*).

The crystallization and demonstration of xanthophyll in leaves, H. MALISCH (*Ber. deut. bot. Ges., 14 (1896), No. 1, pp. 18–29, pl. 1*).

On the parasites of nuclei and protoplasm, P. A. DANGEARD (*Le Botaniste, ser. 4, 1895, No. 6, p. 199; abs. in Centbl. Bakt. und Par. Allg., 2 (1896), No. 5, p. 160*).

Concerning the acid properties of root secretions, F. CZAPEK (*Ber. deut. bot. Ges., 14 (1896), No. 1, pp. 29–33*).

A nutrient solution for plant cultures, P. WAGNER (*Abs. in Ztschr. angew. Mikros., 1 (1896), No. 12, p. 377*).—The use of a solution made by the following formula is recommended: Ammonium phosphate 30 parts, nitrate of soda 25 parts, nitrate of potash 25 parts, and sulphate of ammonia 20 parts. This mixture will contain for every 100 parts 13 of nitrogen, 13 of phosphoric acid, and 11 of potash.

Relation between the total fungus growth and the nutrient solution consumed, H. KUNSTMANN (*Inaug. Diss. Leipsic, 1895, pp. 46; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 7–9*).

Investigations on the light requirements of plants with reference to the vegetation of Vienna, Cairo, and Buitenzorg, J. WEISNER (*Sitzungsber. k. Akad. Wissensch. Math.-naturw. Classe, Wien, 104, 1895; abs. in Bot. Ztg., 54 (1896), II, No. 7, pp. 97–102*).

Influence of atmospheric electricity on the growth of plants, A. ALOI (*Bul. Soc. Bot. Ital., 1895, pp. 188–195; abs. in Bot. Centbl., 65 (1896), No. 8, p. 263*).—Experiments conducted with beans and maize showed an increased growth. Electricity in the soil seemed to hasten germination.

Effect of frost on plants, W. SOMMERVILLE (*Trans. Eng. Arboricult. Soc., 3 (1895–'96); abs. in Gard. Chron., ser. 3, 19 (1896), No. 482, pp. 393, 394*).—The effect of frost on plants and the theory of ice formation within the intercellular spaces are stated and the way in which injury is done to the plant by rapid thawing is shown.

On combating the evil effects of a late frost, F. NOACK (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, p. 52*).

Influence of soil on the subterranean parts of plants, J. DUFOUR (*Compt. Rend. Français Assoc. Advancement Sci., 1895, pp. 596–599; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 29, 30*).—Experiments with radishes in clay, sand, and lime soils gave the best roots in clay-containing soils. Similar results have been secured by the author with *Dioscorea batatas* and *Stachys tuberifera*. With the latter the highest production and weight were secured in soil containing clay, sand, and lime, and the lowest where only sand and lime were present.

Root symbiosis and mycorrhiza, G. F. L. SARAUW (*Bot. Tidsskr., 18, pp. 127-259, pls. 2; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 24-27*).

The fixation of free nitrogen by plants, J. GIELE (*Rev. Agron., 4 (1895), No. 4, pp. 321-328, figs. 2*).

The root tubercles of soja bean, O. KIRCHNER (*Cohn's Beiträge Biol. Pflanzen, 7 (1895), No. 2, pp. 213-224; abs. in Bot. Ztg., 54 (1896), II, No. 7, pp. 106, 107*).—The author describes the bacterium of the soja bean under the name *Rhizobacterium japonicum*.

Concerning the action of the bacteria of legume tubercles toward quicklime, TAKE, IMMENDORF, HESSENLAND, SCHÜTTE, and MINSSEN (*Mitt. Ver. Ford. Moorkultur, 13 (1895), pp. 380-399; abs. in Centbl. Bakt. und Par. Allg., 2 (1896), No. 5, pp. 161-163*).

On protein crystalloids and their probable relation to the nutrition of the pollen tube, L. H. HUIE (*La Cellule, 9 (1895), pp. 83-92; abs. in Bot. Centbl., 65 (1896), No. 4, pp. 114, 115*).

Tannin dyes and their use in plant anatomy, L. KOCH (*Jahrb. wiss. Bot., 29; abs. in Ztschr. angew. Mikros., 1 (1896), No. 12, pp. 375-377*).

Methods of studying and staining living and dead cells and tissues, G. MARPMANN (*Ztschr. angew. Mikros., 1 (1896), Nos. 11, pp. 321-330; 12, pp. 353-367*).

The quartzspectograph and some investigations with it on the coloring matter of plants, A. TSCHIRCH (*Ber. deut. bot. Ges., 14 (1896), No. 2, pp. 76-91, pls. 2*).

The microscope and its use, L. DIPPEL (*Das Mikroskop und seine Anwendung. Braunschweig: Vieweg & Sohn, 1896, pp. 443*).

A method for embedding small objects, L. RHUMBLER (*Ztschr. wissensch. Mikros., 12 (1896), pp. 312-314; abs. in Bot. Centbl., 65 (1896), No. 12, pp. 411, 412*).

On the race breeding of agricultural plants as a subject of scientific inquiry, K. VON RUMKER (*Festschr. zum 70. Geburtstag J. Kuhn, 1895, pp. 51-72; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 24-26*).

Some observations on Dr. W. Rimpau's wheat and rye cross, K. MICZYNSKI (*Jour. Landw., 43 (1896), No. 4, pp. 359-368*).

Graft hybrids, F. A. WAUGH (*Amer. Hort., 6 (1896), No. 3, p. 41*).—Cites a few instances where the fruit of the scion has been influenced by the stock.

The purposes of ethno-botany, J. W. HARSHBERGER (*Bot. Gaz., 21 (1896), No. 3, pp. 146-154*).

Useful plants of Australia, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 5-8, pls. 2*).—Notes are given on *Tristania conferta*, a valuable timber tree, and on *Panicum marginatum*, a grass thought to have some merit.

The Uredineæ of Chile, F. W. NEGER (*Anal. Univer. Santiago, 1895, pp. 2; abs. in Bot. Centbl., 67 (1896), No. 8, pp. 256, 257*).

Studies of the vegetation of Jendland from the standpoint of agriculture, forestry, and geology, E. HENNINGS (*Abs. in Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 35, 36*).

Botanical notes, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 38-40*).—A few additions are made to previous lists of plants and notes are given of the migration of weeds; of the latter the common thistle (*Carduus lanceolatus*), *Hordeum murinum*, and Paddy lucern (*Sida rhombifolia*) are mentioned.

A preliminary list of the indigenous plants of Sao Paulo, A. LOFGREN (*Commissao geog. e geol. S. Paulo, Bul. 10, pp. 115*).—A preliminary list is given of the indigenous plants arranged alphabetically according to their common names. The scientific names and descriptions of the plants are also given.

The native and cultivated plants of Sweden, A. LYTTKENS (*Meddel. fr. Kgl. Landtbr., 3 (1894), pp. 87*).—A list of the native and cultivated plants of Sweden is given, in which may be found both the scientific as well as the common names of the plants. It can be considered a reliable dictionary of the Swedish and scientific names of the plants occurring in the region designated.—T. HOLM.

Botany of Yakutat Bay, Alaska, F. V. COVILLE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 3, No. 6, pp. 325–353*).—A report is given upon a collection of plants made by F. Funston in 1892, together with field report by the collector. About 150 species of vascular and cellular plants are represented in the collection.

WATER—SOILS.

The behavior of cultivated plants toward the water content of the soil, O. A. AVÉDISSIAN (*Inaug. Diss., Giessen, 1895; abs. in Forsch. Geb. agr. Phys., 18 (1895), No. 5, pp. 156, 157*).—Experiments in pots containing 1,750 gm. of soil to determine the amounts of water in the soil with which oats and peas produce maximum yields of green matter and dry substance are reported.

Six plants were grown in each pot, and at the beginning the pots received like amounts of water, but this was varied after about the first of May. On June 26 the above ground part of the most vigorous plant in each pot was removed and weighed in the green and dry state. The results show that the maximum amount of green and dry substance was produced by oats when the soil contained 26.57 per cent of moisture, while for peas 30.11 per cent was required. The oat plant required more moisture during the early stages of growth than during the later stages. On April 8, with 5 per cent of moisture, the plants wilted, while on June 12, with the same amount of moisture, they continued to grow, and on June 25 the moisture sunk to 3 per cent without killing the plants. The opposite was true with the peas. On May 29 they were able to live with only 3 per cent of moisture, while on June 12 they wilted with 5 per cent. Rapid evaporation appeared to be more injurious to the oat plants during their early stages of growth than excessive moisture, while it did not injure the pea plants. The percentage of water in the oat plants increased very uniformly with that in the soil, while with pea plants this was not the case.

Researches on the permeability of the soil, P. P. DEHÉRAIN and E. DEMOUSSY (*Ann. Agron., 22 (1896), No. 2, pp. 49–86, fig. 1*).—The method used in these investigations consisted essentially in measuring the resistance which a given amount of soil in the dry and wet condition offered to the passage of air and water. The soil was placed in a funnel fastened by a rubber stopper in the mouth of an Erlenmeyer flask having a side tube connected with a kind of mercury pump. The resistance to the passage of the air and water through the soil was measured by the fluctuations in height of the mercury column. Three observations were always made, viz, maximum resistance, fixed resistance, for which correction was necessary in wet soils, and water retained. The influence of fineness, compactness, and method of watering was studied on sand, clay, calcareous soils, and humus, and also on various typical soils of France.

The causes of impermeability of arable soils and the effect of liming

on this property were also investigated. The results are reported in detail, and the following conclusions are drawn:

(1) The impermeability of a soil is due to obstruction of the spaces through which air and water usually pass. When water breaks up the soil aggregates the small particles are washed into these spaces, obstructing them and interfering with percolation. Lime flocculates the fine particles of clay and prevents them from being washed into the soil spaces, thus keeping them open.

(2) The amount of water which a soil will retain depends upon its porosity. When the soil aggregates have been broken up by water the porosity of the soil is reduced and its water-holding power diminished. For this reason it may happen that a soil actually contains less water after a prolonged rain than after a moderate rainfall which moistens the soil completely, but does not break the soil aggregates.

(3) Liming prevents packing and puddling; it thus improves drainage and at the same time favors the storage of water in the soil.

On the analysis of soils by plants, G. LECHARTIER (*Compt. Rend., 121 (1895), No. 21, pp. 866–870*).—Analyses are reported of alfalfa grown in plats of soil well supplied with all fertilizing constituents and on those deficient in potash. There was great uniformity of composition in each case, but the plants in the soil poor in potash did not make a normal growth. Analysis showed them to contain only about half as much potash as plants grown on the well-fertilized plats.

From the results of these studies, as well as from those of others on artichokes, the author believes it is possible to determine the deficiencies in fertilizing constituents of a soil by comparing the composition of the imperfectly developed plants grown on such a soil with the normal composition of plants grown on soil supplied with the proper proportions of the fertilizing constituents.

A new method of mechanical soil analysis, B. SJOLLEMA (*Chem. Ztg., 19 (1895), No. 93, p. 2080*).—The method proposed is as follows: Boil 10 gm. of fine earth with water, and a little hydrochloric acid if necessary, to break up the clay aggregates. Decant the water and dry and gently grind the residue. Add a little Thoulet solution (iodid of potassium and iodid of mercury in the proportion of 1 to 1.24, sp. gr. 2.51) and make into a thin paste. Wash into the cylinder of a small centrifuge with the same solution, making up the volume to 50 cc., rotate for 5 to 10 minutes at a velocity of about 600 revolutions per minute, and allow to stand for a few minutes. The specific gravity of the solution used is such that by this operation the sand sinks to the bottom of the tube and is somewhat stratified in the order of fineness, while the clay collects in a thin layer on the surface of the liquid, the liquid itself being perfectly clear. The results by this method in separating clay from sand are stated to agree closely. The author hopes to be able, by varying the velocity of revolution, to develop a reliable method of separating the sand into different grades.

Conservation of soil moisture by subsoil plowing, T. L. LYON (*Indian Agr., 21 (1896), No. 1, pp. 22, 23*).

Study of the water of the soil, F. H. KING (*Ann. Agron., 22 (1896), No. 4, pp. 161-171*).—Translated from the English (Wisconsin Sta. Rpt., 1894, pp. 174-200).

Investigations concerning the relations of different kinds of soil to moisture, E. WOLLNY (*Forsch. Geb. agr. Phys., 18 (1895), No. 1-2, pp. 27-62*).

The importance of water in plant production, T. F. HUNT (*Clay Record, 8 (1896), No. 5, pp. 22-25*).

Investigations on the temperature of the soil and the evaporation of soil water, BÜHLER (*Mitt. Schweiz. Centralanstalt forst. Versuchswesens, 4, pp. 257; abs. in Centbl. agr. Chem., 25 (1896), No. 3, pp. 145-150*).

Investigations on the mechanical analysis of soils, W. R. WILLIAMS (*Forsch. Geb. agr. Phys., 18 (1895), No. 3-4, pp. 225-250*).

Soil analysis, F. B. GUTHRIE (*Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 58-62*).—A discussion of methods.

Notes on "soluble salts" in soil, A. H. CHURCH (*Agl. Students' Gaz., 7 (1896), No. 6, pp. 212-214*).—A brief discussion of this subject with special reference to alkali soils (of India). An analysis of alkali from Allahabad, India, is reported.

Analyses of Caledon soils, J. MULLER (*Agl. Jour. Cape Colony, 9 (1896), No. 6, pp. 132-134*).—Analyses of 30 soils from different sections of the Caledon district of Cape Colony are reported. The average of these analyses is as follows: Lime 0.053 per cent, potash 0.061, phosphoric acid 0.051, and nitrogen 0.150. "Theoretically, if these grain lands be cultivated with wheat and left unmanured they will be completely exhausted of all lime in 88 years; in 40 years all potash will be taken out; while in 35 years the supply of phosphates in the soil will be exhausted."

FERTILIZERS.

How to keep up the fertility of our farms, W. P. BROOKS (*Agriculture of Massachusetts, 1894, pp. 76-118*).—The leading points discussed in this article are the dependence of the productiveness of soils upon their physical character; the necessity of good drainage, fall plowing, and thorough tillage in order to secure the best effects of manures and fertilizers and to utilize to the best advantage the natural resources of the soil; the retentive power of the soil for phosphoric acid and potash as contrasted with the readiness with which it parts with soluble nitrogen; the use and value of autumn catch crops to increase and conserve the nitrogen of the soil; the advantage of applying manure when fresh; the desirability of reducing the proportion of phosphoric acid and increasing that of potash in special fertilizers; the advantage of using barnyard manure and commercial fertilizers together, thus enabling the farmer to utilize one of the most economical means of maintaining the fertility of his soil; and the advisability of using as a source of phosphoric acid the cheaper natural phosphates, of potash the muriate, and of nitrogen mixed materials of different degrees of availability. If nitrate of soda is used it is recommended that it be applied at 2 or more different times and but slightly in excess of the requirements of the crop. It is also recommended that a careful record be kept of the cost of production of the different crops and that in general both barnyard manure and fertilizers be applied broadcast.

"In some cases a part of the quick-acting fertilizer may with advantage be put in the hill or drill. For potatoes, drill application of all the fertilizer has given a larger yield than broadcast in 3 experiments. This was upon land of moderate fertility.

"For crops in general, materials supplying from 40 to 60 lbs. of nitrogen, from 40 to 60 lbs. of phosphoric acid, and from 60 to 100 lbs. of potash will generally give satisfactory results, provided a system of rotation including some legume is followed to furnish a part of the nitrogen. If this is impracticable, considerably more of this element must be furnished."

Recent researches on the transformations which nitrogen undergoes in the soil, PAGNOUL (*Ann. Agron., 21 (1895), No. 11, pp. 497–501*).—This is an account of pot experiments undertaken to study (1) the power which bisulphid of carbon possesses of arresting nitrification and (2) the denitrifying action which Wagner attributes to fresh manure.[1] One dozen pots, each containing 25 kg. of soil and uniformly fertilized with 20 gm. each of superphosphate and muriate of potash, were divided into 2 series of 6 each May 24. One series was kept bare during the greater part of the period of the experiment, while the other was planted to white mustard. In each series the pots received (1) 30 gm. of nitrate of soda, (2) 30 gm. of nitrate of soda and 500 gm. of horse manure, (3) same as 2 with 50 cc. of bisulphid of carbon, (4) 25 gm. of sulphate of ammonia, (5) 25 gm. of sulphate of ammonia and 500 gm. of horse manure, and (6) same as 5 with 50 cc. of bisulphid of carbon. Determinations of nitrogen in different forms at the beginning and at different periods during the progress of the experiment showed that in case of bare soils receiving nitrate of soda there was a rapid decrease of nitric nitrogen from May 24 to August 8. The proportion of this form of nitrogen was maintained highest throughout in the pot containing manure in addition to the nitrate and lowest in the pot receiving bisulphid of carbon in addition to nitrate and horse manure. The soils receiving sulphate of ammonia (May 10) without the addition of bisulphid showed considerable amounts of nitric nitrogen May 24 and the ammoniacal nitrogen had almost entirely disappeared June 11. In the pot, however, which received bisulphid in addition to horse manure and sulphate of ammonia only traces of nitric nitrogen were found up to June 21. After that date the paralyzing action of the bisulphid on the denitrifying organisms appears to have ceased and by August 8 the ammoniacal nitrogen was almost entirely transformed into nitric nitrogen. The results obtained with the pots bearing mustard plants confirm those on bare soil in indicating that although the bisulphid of carbon temporarily checked the action of the nitrifying organisms there was no indication that the manure produced any denitrification. The latter is contrary to the conclusion arrived at by Wagner.

Comments on the preceding article, P. P. DEHÉRAIN (*Ann. Agron., 21 (1895), No. 11, pp. 501–508*).—The investigations of A. Girard,

[1] For an account of previous work in this line by the author see Compt. Rend., 120 (1895), p. 812 (E. S. R., 7, p. 22).

E. Bréal, G. Paturel, J. Reiset, P. Wagner, and the author on the question of denitrification in the soil as affected by applications of fresh manure and bisulphid of carbon are briefly reviewed, and it is shown that Pagnoul's results in general confirm those of other investigators in indicating simply a temporary checking of the action of the nitrifying ferments in the soil by bisulphid of carbon; but as regards the denitrifying effect of fresh manure, his conclusions are at variance with those of other investigators, particularly those of Wagner. It is suggested that this discrepancy may be explained by the difference in the composition and character of the manure employed, due to the character of food from which it was produced, but it is pointed out that this question should receive further investigation.

Bacteriological-chemical investigations on the causes of the loss of nitrogen in decomposing organic materials, especially stable manure and urine, R. BURRI, E. HERFELDT, and A. STUTZER (*Jour. Landw., 43 (1895), No. 1-2, pp. 1-11*).—Two series of culture experiments are reported, in one of which nutrient solutions were inoculated with old decomposed liquid manure and in the other with fresh liquid. The different materials which have been recommended as manure preservatives were added to the cultures in different cases and their effect in checking or preventing decomposition noted.

The conclusions reached are as follows:

(1) Gypsum has no value as a preservative. It does not combine with the carbonate of ammonium already present and does not prevent further formation of this substance even when used in large quantities.

(2) Kainit checks the formation of ammonia to a marked extent, but when used alone it is not an absolutely safe preventive of loss of ammonia.

(3) Precipitated phosphate (dicalcium phosphate) appears to possess no value as a preservative.

(4) Superphosphate gypsum as well as free phosphoric acid are very effective preservatives.

The simultaneous use of phosphates and nitrate of soda, L. GRANDEAU (*Jour. Agr. Prat., 60 (1896), No. 9, pp. 309-312*).—Summarizing the results of experiments during 1895 in 21 departments of France, under the direction of the departmental professors of agriculture, the following conclusions are drawn:

(1) The presence of a sufficient amount of potash and phosphoric acid in the soil is essential to the successful use of nitrate of soda.

(2) The use of 89 lbs. of nitrate of soda per acre, preferably in 2 applications, produced in a soil well supplied with phosphoric acid 6 or 7 bu. increase of grain (wheat, oats, barley), and frequently more.

(3) Nitrate of soda proved superior to sulphate of ammonia.

(4) In all cases where nitrate was used judiciously (89 to 133 lbs. per acre) in connection with phosphates it was profitable.

The fertilizing action of magnesia and sulphate of iron, A. LARBALÉTRIER and L. MALPEAUX (*Ann. Agron., 22 (1896), No. 1, pp. 20–32*).—Attention is called to the fact that the rôle of magnesia in plant growth and its influence as a fertilizer are very imperfectly understood, and the investigations on the subject are briefly reviewed. A report is given of field experiments carried out during 1895 on a soil containing 0.21 per cent of magnesia with sulphate and carbonate of magnesia applied at the rate of 300 kg. per hectare (267 lbs. per acre) on oats, potatoes, fodder corn, beans, poppies, and sugar beets. At the same time comparative tests of sulphate of iron applied at the rate of 150 kg. per hectare were made on some of these crops.

The results were not very decisive, and seem to indicate that a soil containing 0.21 per cent of magnesia does not need applications of magnesia. It appears that the sulphate was more effective than the carbonate, but that applications of magnesia in either form, alone, will not pay their cost.

The results with sulphate of iron were also indefinite as a rule.

The magnesia (especially the sulphate) appeared to increase the starch in potatoes, but had little effect on the sugar content of the beets, while the sulphate of iron seemed to reduce the starch in potatoes and to increase the sugar in the beets.

Questions of manuring with reference to recent experimental results, P. WAGNER (*Deut. landw. Presse, 23 (1896), Nos. 27, pp. 232, 233, figs. 6; 29, pp. 253, 254, figs. 5; 31, p. 271, figs. 2*).

Are nitrates indispensable to crops? O. PITSCH and J. VAN HAARST (*Ann. Agron., 22 (1896), No. 4, pp. 179–181*).—Translated from the German.

The agricultural utilization of city sewage, G. PATUREL (*Ann. Agron., 22 (1896), No. 4, pp. 171–179*).—Recommends the mixing of calcareous sand with the sewage before it is applied to the soil

Do the sewage irrigation fields influence general health? T. WEYL (*Berl. klin. Wochenschr., 1896, No. 1; abs. in Chem. Centbl., 1896, I, No. 12, p. 658*).—In a lecture before the Medical Society of Berlin the author presented statistics gathered by himself to show that the mortality of inhabitants of these fields was materially less than that of Berlin.

The utilization of the waste products of cities (*Deut. landw. Presse, 23 (1896), Nos. 19, p. 161; 20, p. 171; 21, p. 179*).

The manure value of food, R. WARINGTON (*Mark Lane Express, 13 (1896), No. 1163, p. 113*).

The report on the conservation of manure to the International Congress of Agriculture at Brussels, A. MÜNTZ (*Ann. Sci. Agron., ser. 2, 2 (1894–'95), Nos. 2, pp. 311–320; 3, pp. 321–336*).

The preservation of stable manure, P. WAGNER (*Neue Ztschr. Rubenz. Ind., 36 (1896), No. 14, pp. 154–157*).—It is stated that the principal object in the preservation of manure should be to prevent the transformation of the nitrogen of the urine into ammonia. This will not occur by bacterial action in very acid or very alkaline urine. The two most promising methods of preservation, therefore, are the use of sulphuric acid or of lime. The first is quite effective, but has certain obvious disadvantages for practical purposes. The second will result in loss of nitrogen if the urine has partially decomposed before it is applied. The author claims to be experimenting with a method which he hopes will be both effective and practicable.

The principles of the construction of manure yards and urine pits (*Deut. landw. Presse, 22 (1895), No. 78, pp. 708, 709, figs. 5*).

How to compost and use hen manure (*Amer. Agr. (middle ed.), 1896, Apr. 11, pp. 419–421*).

The cheapest source of nitrogen (*Amer. Agr. (middle ed.), 1896, May 2, p. 520*).—An argument to show that linseed meal at $19 per ton, the price it has been bringing at Atlantic ports, is a cheaper source of nitrogen for fertilizers than cotton-seed meal.

Analyses of commercial fertilizers, T. J. EDGE and W. FREAR (*Pennsylvania Dept. Agr. Bul. 5, pp. 38*).—Tabulated analyses and valuations of 533 samples of fertilizers examined during the year 1895, accompanied by the text of the State fertilizer law, notes on valuation, etc.

Commercial fertilizers, W. L. HUTCHINSON (*State Chemist Mississippi, Buls. 9, pp. 10, and 10, pp. 3*).—Analyses and valuations of 49 samples of fertilizers offered for sale in Mississippi during the season of 1895-'96 are reported.

Analyses of commercial fertilizers, H. J. WHEELER, B. L. HARTWELL, and C. L. SARGENT (*Rhode Island Sta. Bul. 33, pp. 33–47*).—Tabulated analyses of 76 samples of fertilizing materials, including muriate of potash, ashes, nitrate of soda, dried fish, tankage, bone, and mixed fertilizers.

Gypsum in Oregon (*Amer. Fert., 4 (1896), No. 4, p. 184*).—Large deposits near Huntington and Lime Spur are briefly noted.

A contribution to the question of applying lime as a fertilizer, NEUMANN (*Deut. landw. Presse, 23 (1896), No. 32, pp. 281, 282*).

Slag and superphosphates, G. BATTANCHON (*Prog. Agr. et Vit., 25 (1896), No. 10, pp. 271–273*).

On the use of phosphatic fertilizers, G. BATTANCHON (*Prog. Agr. et Vit., 25 (1896), No. 2, pp. 39–43*).

Considerations on the use of phosphatic fertilizers, P. P. DEHÉRAIN (*L'Engrais, 11 (1896), No. 5, pp. 112–114*).

On the solubility of phosphatic slags, L. GRANDEAU (*Jour. Agr. Prat., 60 (1896), No. 4, pp. 127–131*).

Thomas slag for moist lands rich in organic matter (*Rpt. Agl. Chem. Lab. Bologna, 23 (1895), pp. 15–22*).—A brief review of work of various investigators.

The insoluble phosphates (*Rev. Agron., 4 (1896), No. 4, pp. 333–336*).

Why should we use potash manures? C. M. AIKMAN (*Agl. Gaz. (London), 43 (1896), No. 1166, pp. 415*).—A popular article.

On the injurious effects of spring applications of fertilizers in moor culture (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, p. 53*).—Kainit and Thomas slag should be applied in the autumn, as spring applications are said to reduce the sugar and starch content of hoed crops grown upon moorland.

Manuring light soils, G. SCHULTZE (*Deut. landw. Presse, 22 (1895), Nos. 75, p. 679; 76, p. 686; 77, p. 697*).

Proceedings of the fertilizer section of the German Agricultural Society (*Jahrb. deut. landw. Ges., 10 (1895), pp. 48–66, 126–145, fig. 1*).—The topics of special interest discussed were the extensive use of natural manures (human and animal), prevention of loss of nitrogen in manure, the citrate solubility of Thomas slag, and green manuring and catch crops.

FIELD CROPS.

Investigations of the chemical history of the barley plant, C. F. CROSS and C. SMITH (*Chem. News, 72 (1895), No. 1883, p. 307*).—The authors have during the 2 years 1894 and 1895 investigated the "permanent tissue" of barley plants grown on permanently unma-

nured and manured plats of the Royal Agricultural Society farm at Woburn. "Permanent tissue" is designated as that part of the plant left after extraction with alcohol and boiling successively with 2 per cent of sodium hydroxid and with hydrochloric acid. Samples were taken for examination at different stages in the growth of the plants. The results are presented in tabulated form. From these data the authors conclude that—

"The conditions of soil nutrition have very little influence upon the composition of the plants. . . . The plant, in other words, is, as regards soil nutrition, constant or invariable in respect to the relation of its products to assimilation. If we had had the selection of extreme variations of season, we could not have chosen better than as between 1894 and 1895. The influence upon the experimental numbers is extreme, more especially in regard to permanent tissue. In the comparatively wet season of 1894 there is a steady increase of permanent tissue; in 1895 the brilliant and continuous sunshine of the period, up to and including that of flowering, determined a totally different course. The proportion of easily hydrolysable carbohydrates shows a steady increase during the maturation period at the expense of permanent tissue. The total dry matter, on the other hand, was influenced only in the stages up to and somewhat after the flowering period. Dehydration was, for obvious reasons, much more active in 1895. . . . The feeding value of straws grown in dry seasons is high, and, conversely, the paper-making value of such straws is low. Moreover, while we may well assume a diminished feeding value of the 1894 straw during the period of maturation, it would appear that in 1895 there is an actual increase of feeding value of the mature straw over the straw taken at the flowering period. . . . In the early and late periods of growth the furfuroids are in the main of cellulosic character. The greatest divergence is seen to occur at the most active period of growth, and here there is an accumulation of easily hydrolysable furfuroids. The maximum proportion was similar in the 2 seasons. In both crops there is a gradual rise to and following from the maximum. In the 1895 crop there was a marked change after cutting, and the change in the character of the furfuroids was continued by a retrograde change in the permanent tissue. This retrograde movement was continuous from the flowering period, and in exact contrast to the history of assimilation in 1894.

"A fair interpretation of the results appears to be this: The furfuroids are by no means excreted products, but available for assimilation, and they are in fact continuously assimilated to permanent tissue (cellulose). Owing to the deficient moisture in the period to July 16, the building up of new matter (growth) was interfered with, and the permanent tissue was put under contribution for nutrient material, which under ordinary conditions would have been drawn from cell contents and not from tissue.

"In the month July 16 to August 16 there is in fact a notable falling off in the total quantity (proportion) of furfuroids, which confirms the view that these constituents were put under contribution selectively to the general needs of the plant.

"Viewed broadly and generally, these investigations show how very different are the results of physiological study of the history of crops from those of investigations of soil nutrition. The essential characteristics of the plant are maintained independently of the factors of soil nutrition. The comparative study of the 2 crops proves this conclusively. In our opinion systematic investigation of the actual physiological (*i. e.*, chemical), constants of the plant will lead to results of which at present it is impossible to predict the import."

Experiments with oats (*Kentucky Sta. Bul. 57, pp. 81–86*).—This is a continuation of work previously reported in Bulletin 42 of the station (E. S. R., 4, p. 342).

Test of varieties (pp. 84, 85).—Tabulated data are given for 31 varieties of oats grown on fortieth-acre plats. The season was too dry when the oats were heading. The yields range from 15.5 to 49.2 bu. per acre. Droghead Irish Imported, Early Archangel, Badger Queen, American Banner, and Australian gave the largest yields.

Test of fertilizers (pp. 85, 86).—The oats were grown after 6 successive crops of potatoes. The same kinds and amounts of fertilizers used on the potato plats were applied on the oat plats. On 7 plats 160 lbs. nitrate of soda, 160 lbs. muriate of potash, and 140 lbs. double superphosphate per acre were applied singly, 2 by 2, and all 3 together. On 3 plats no manure was applied.

"[The author concludes that] the results are interesting, but further investigation must be made before conclusions can be drawn. From the results obtained it would appear that nitrate of soda has no beneficial effect, but was rather injurious to the best results, while both muriate of potash and double superphosphate each seemed to produce increased yields."

Influence of the specific gravity of seed potatoes on the yield and quality, E. WOLLNY (*Forsch. Geb. agr. Phys.*, *18* (*1895*), *No. 3–4, pp. 359–361*).—The author reviews previous European work in this line (E. S. R., 4, p. 959), all of which tended to show that no definite relation was apparent between the specific gravity and the starch content of the seed tubers on the one hand and the yield of tubers and the starch content on the other. Tubers of a high specific gravity always have a high content of starch.

The contradictory results announced by G. Marek[1] led the author to make a further investigation of this question.

In all 19 trials were made, using 17 varieties of potatoes. Each trial was conducted with 40 plants, on an area of 27½ by 27½ in. per plant.

Two trials were made in 1893 on land manured with 500 kg. of poudrette per hectare, and 17 trials in 1894 on land manured with 500 kg. per hectare of a mixture of superphosphate, muriate of potash, and nitrate of soda. Tubers of equal weight and medium size were selected from different varieties, and the tubers of high and of low specific gravity were separated by means of a brine.

In 1894, from the potatoes harvested in each of the above trials, medium sized tubers of equal weight were selected and their average specific gravity determined by means of brine. The results are tabulated and discussed.

The author states that in 12 out of the 19 trials (63 per cent) an increase in the yield followed the use of heavy seed tubers as opposed to those of lower specific gravity, although the increase was on the whole insignificant; while in the remaining cases (37 per cent) the specific gravity of the seed tubers had no apparent influence on the yield; that tubers rich in starch in the majority of cases (13 out of 17) pro-

[1] Fühling's landw. Ztg., 41 (1892), Nos. 5 and 6.

duced larger tubers than those poor in starch, but that in general the respective differences were insignificant.

The tubers grown from seed of a high specific gravity were richer in starch in 15 trials and poorer in 3 trials than tubers from seed of a low specific gravity.

There were quite large differences in the starch content of the seed tubers; in the harvested tubers the starch content differed materially from that of the seed tubers, and in a single variety it underwent great variations in different years. These facts lead to the conclusion that the starch content of the harvested tubers is controlled less by the seed tubers than by other influences, and that the effectual improvement of a variety of potatoes by using seed of a high specific gravity will be a difficult matter.

Varieties should rather be improved by developing their individual qualities, by planting tubers rich in starch, grown from stock distinguished for its productiveness and having the capability of transmitting its good qualities; for only the inherent qualities of the individual are constantly transmitted, while those qualities called forth by outside causes are only retained so long as the conditions of life remain unchanged.

The effect of liming upon the development of potato tubers, H. J. WHEELER, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Bul. 33, pp. 46–50*).—A trial in connection with a soda substitution experiment described in the Annual Report of the station for 1894 (E. S. R. 7, p. 377). Forty eight sixtieth-acre plats received a uniform application of nitrogen and phosphoric acid; the carbonates and chlorids of potash and soda were also applied in different combinations and proportions.

On another plat, subdivisions 18 by 30 ft. in size received 600 lbs. of dissolved boneblack and 200 lbs. of muriate of potash. On these subdivisions nitrate of soda, when used, was applied at the rate of 472.4 lbs. per acre, and dried blood and Pennsylvania tankage were so used as to furnish the same amount of nitrogen per acre. The limed subdivision received per acre 2½ tons of air slacked lime in 1893 and ½ ton in 1894. On these subdivisions and on 2 of the permanent sixtieth-acre plats seed tubers treated with corrosive-sublimate solution alternated with untreated seed. The results are tabulated. The average percentage of large tubers on limed plats was 74.2 and of small tubers 25.8; on unlimed plats the percentages were 63.3 and 36.7, respectively.

The potato scab was much worse on the limed plats than on those receiving no lime.

The author draws the following conclusions:

"(1) Upon our sour or acid soil, which contains probably no calcium carbonate, potato tubers practically free from the scab may be grown, even if the seed tubers are infested with the germs of the disease, provided commercial fertilizer and not barnyard manure is employed.

"(2) On soil which is not acid, or where barnyard manure or lime in forms other than land plaster (gypsum) is frequently employed, all seed tubers should be treated with corrosive-sublimate solution before planting. Under such circumstances crops of potatoes should not follow each other at close intervals, or the damage from the scab may be increased.

"(3) If the character of the land is unknown, all seed tubers should be subjected to the corrosive-sublimate treatment, even when commercial fertilizers are employed, provided one wishes to secure a smooth crop.

"(4) On sour or acid soil a gain in total yield of potato tubers may result from the use of air-slacked lime, and our own experiments show a decided gain in the percentage of tubers of merchantable size.

"(5) If lime is to be used on acid land where potatoes are to be grown, it should not be employed in quantities greater than 1 to 1½ tons per acre at a single application, and the rotation should be so arranged that 2 or 3 crops intervene between the time of liming and the growing of the potatoes. A good arrangement would be to lime before rye, Indian corn, oats, or barley, and then follow with clover before the potatoes.

"(6) It may be possible by such an arrangement on acid soils, provided the corrosive-sublimate treatment of the seed tubers is employed, that much of the benefit upon the potato crop from liming and also practical immunity from the potato scab may be enjoyed."

Comparative field test of commercial fertilizers used in raising potatoes (*New York State Sta. Bul. 93, n. ser., pp. 12*).—A preliminary trial made on a farm on Long Island under the supervision of a representative of the station. The soil was a loam 2 to 3 ft. deep, with a subsoil of sand and gravel. The field was marked out into 26 plats of 3 rows each, with a vacant row between adjacent plats. Ten different kinds of commercial fertilizers were used. These were applied at the rate of 1,000, 1,500, and 2,000 lbs. per acre, and broadcast and in the row. Tabulated data are given for analyses of fertilizers, the amounts of the fertilizing ingredients contained in 1,000 lbs. of these fertilizers, amounts of fertilizing constituents applied, yield of potatoes, the cost of fertilizer, and the gain or loss per plat.

In general, the author concludes that in every instance the yield of potatoes was larger with fertilizers; that the use of 2,000 lbs. of fertilizer per acre was generally unprofitable, and that with smaller amounts of fertilizers it was better to apply in the row; with larger amounts, broadcast.

Tests of sorghum varieties, C. L. PENNY (*Delaware Sta. Bul. 27, pp. 21, dgms. 8*).—These tests were made with the object of improving varieties of sorghum by planting seed from stalks of the highest individual merit. In all 1,400 stalks were gathered at various dates, representing the 6 varieties—Amber, No. 1460, Collier, Colman, McLean, and No. 161. The specific gravity of the juice of each stalk was determined and its sugar content found by the polariscope. Tabulated data are given. In the Amber variety there seemed to be no connection between the richness of the juice and the size of the stalk; in the Colman the richer stalks were larger; in the other varieties the richer stalks were lighter than the poorer ones. The Collier and Colman were first in point of uniformity of richness of juice. The wide

range of the richness and purity of the juice in all the varieties on different days and the rapid fluctuations within the same variety from day to day are shown graphically. This range was widest with Colman and Amber and narrowest with Collier and McLean.

Sugar beets in Washington, E. FULMER (*Washington Sta. Bul. 15, pp. 62*).—A coöperative test of 7 varieties of sugar beets by 384 farmers, each growing 1 to 3 varieties. Analyses made at the station of 1,700 samples of sugar beets, coming from 27 counties, are tabulated. Of these samples 164 contained less than 12 per cent of sugar, 1,283 yielded between 12 and 17 per cent, and 253 over 17 per cent. The highest sugar percentage was 21.9; the lowest, 4.7. For 1,544 analyses the following averages are given: Weight, 22 ounces; sugar, 15.2 per cent; purity, 83.8.

The author states that the Kleinwanzleben seemed to give the most satisfactory results, followed by Vilmorin Improved. Lemaire, Mette, Vilmorin Richest, and Knauer Imperial were about equal. Vilmorin Improved was not adapted to the conditions of soil and climate.

The advantages of the beet-sugar industry for the State of Washington are discussed, and statistical data are given from the report of the sugar bounty division of the Commissioner of Internal Revenue.

Tobacco experiments, W. FREAR and E. J. HALEY (*Pennsylvania Sta. Bul. 30, p. 19*).

Synopsis.—The investigations here reported consisted of a study of the physical and chemical characters of tobacco soils, of the quality of the cured leaves of the crop grown in 1893, and of methods of curing the crop of 1894.

These experiments are in continuation of those reported in the Annual Report of the station for 1893, pp. 82–112 (E. S. R., 6, p. 718), in which publication are recorded the yields on plats differently fertilized. The tobacco soils of 2 localities in Lancaster County were studied with reference to mechanical and chemical properties and conditions of heat and moisture. The Rocky Springs soil was richer in available phosphoric acid, but poorer in available potash and in lime than that at Donegal. The nitrogen in both surface soils was about the same, but the subsoil was richer in nitrogen at Donegal than at Rocky Springs.

"These investigations show the Lancaster soils to be of heavier type than the best wrapper-leaf soils of other districts, and to be somewhat more moist than the average of such soils. So far as examined, however, they are not cooler, but warmer and more equable in temperature. In fertility they are not conspicuously lacking, being, as a whole, rather rich than poor; nor do injurious constituents appear in excessive proportions."

The loss in sweating in the crop of 1893 amounted to 12.82 per cent at Rocky Springs and 9.55 per cent at Donegal, and the loss was greatest where stable manure was used. "The use of phosphoric acid in dissolved boneblack was attended by a thickening of the tissue. Double carbonate [of potash and magnesia] gave a thinner web than sulphate of potash, but produced little effect upon the vein. . . . With nitrate of soda a very dense leaf was obtained."

As to burning quality, no decided differences were noted, except that the duration of glow was least with barnyard manure.

The following methods of curing the crop of 1894 were tested: (1) Air-curing the leaves and stalks; (2) air-curing the leaves alone; (3) cu ing the leaves by the Snow process; and (4) curing the leaves by a modification of the Snow process, employing a lower temperature.

The results as to methods of curing were inconclusive, the product being poor in all cases. The so-called "Cuban process," in which the green leaves were buried for a time in a trench, yielded a product possessing little of the odor or flavor of tobacco.

The culture of tobacco, F. B. MOODIE (*Florida Sta. Bul. 30, pp. 117-138*).—This is a popular article on the culture of tobacco, discussing seeding, soil, setting, fertilizing, cultivating, worming, topping, suckering, harvesting, housing, stripping, grading, and boxing.

The writer thinks that Sumatra tobacco is to be recommended for virgin Florida soils. Sandy loam soil, "not impregnated with lime or clay on the surface," is considered best for cigar tobacco. In addition to shading and mulching, the soil should be treated to an application of compost made of barnyard manure, with muck and cotton seed.

Wheat experiments (*Kentucky Sta. Bul. 57, pp. 75-83*).—This is a continuation of work reported in Bulletin 42 of the station (E. S. R., 4, p. 342). Sixteen varieties of wheat were grown to compare their relative merits and to test deep *vs.* shallow planting, thick *vs.* thin seeding, and the effect of fertilizers. Data relating to meteorological conditions, yields, etc., are tabulated. Fifteen per cent of the crop was winterkilled. The season was unfavorable, all the varieties rusted badly, and the heads did not fill well. English sparrows were also very destructive, and impaired to some extent the accuracy of the results. In the variety tests the yield per acre varied from 7.5 bu. to 16.8 bu. per acre. Democrat, Unnamed, Lancaster Long Red, and Jones Winter Fife gave largest yields. The fertilizers applied made no difference in the wheat that could be noted in the spring following; the yields with fertilizers ranged between 9.6 bu. and 14.2 bu. per acre. The author gives no conclusions.

Wheat-growing experiments, E. M. SHELTON (*Queensland Dept. Agr. Bul. 6, 2d ser., pp. 30*).—This is a test of several hundred varieties with special reference to their rust resisting qualities.

At the 2 stations where the largest number of varieties was tested those showing the highest rust-resisting power were the following: "Australian Wonder, Blount Lamrig, Buckley Rust-Proof, Fluorspar, Gore Indian, Improved Baart, Indian Early, Pearl, Inglis Battlefield, Leak, Manitoba, Marshall Nos. 3, 4, 7, 8, 10, 11, 15, 22, 24, 35, 36, and 37, Marshall Success, Sicilian Baart, Summer Club, Tourmaline, Town and Country, Ward White, Wheaton Rust Proof, and White Fife. . . . Several, notably Marshall Nos. 3, 4, and 10, Buckley Rust-Proof, Wheaton Rust-Proof, and Summer Club, are among the new wheats that are very promising."

Rust was especially abundant among many varieties belonging to the Australian group of purple-straw wheats.

Report of agriculturist, W. C. LATTA (*Indiana Sta. Rpt. 1894, pp. 31–38*).—This is a brief statement of the work of the year, with a summary of previous data.

Wheat (pp. 31–34, 37).—Out of 37 varieties under trial 1 to 11 years the leading ones in the order of their average yields were Jones Winter Fife, Early Red Clawson, Rudy, Velvet Chaff (brown, smooth), Velvet Chaff (brown, bearded), and Raub Black Prolific. Wheat sown September 20 gave the highest average yield for 6 years.

Corn (pp. 31–38).—Out of 28 varieties under trial 1 to 8 years the leading ones were White Prolific, Boone County White, Yellow Nonesuch, Riley Favorite, Haben Holden, and Purdue Yellow.

Rotative cropping and continuous grain growing without manure (pp 34,35).—During 14 years' trial the average gain per acre from rotative cropping was 5 bu. with oats and corn and 7 bu. with wheat; the average percentages of gain were 19 with corn and oats and 47 with wheat.

The production of barley for malting, A. DAMSEAUX (*Ann. Sci. Agron., ser. 2, 1 (1896), No. 2, pp. [illegible]–212*).—The author treats of area sown to barley in Europe, varieties, qualities desirable in a malting barley, the best soil, manure, place in rotation, preparation of each, sowing the seed, enemies and diseases, harvesting, and threshing.

Culture experiments with the horse, or giant, carrot, SCHIRMER (*Deut. landw. Presse, 23 (1896), No. 22, p. 189*).

Flax farming on the Continent (*Jour. [British] Bd. Agr., 1897, No. 2, pp. 136–140; Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 44–47*).—A short article, giving in brief the cultural and harvest methods pursued in Russia, Austria, Italy, Belgium, and France, the acreage of the different countries being in the order named. Tabulated statistics of the yields for the past 5 years are also given.

Flax culture, J. M. WELLS (*California Fruit Grower, 18 (1896), No. 16, pp. 302, 303*).—A brief general article on the cultivation and preparation for market, the growing of flax in California being discouraged.

Notes on Hierochloa rariflora, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, p. 81*).—This grass, which is said to be scented, is reported as a valuable winter and early spring grass, but worthless when old.

On the use of chemical fertilizers on maize, A. CARRÉ (*Prog. Agr. et Vit., 25 (1896), No. 17, pp. 453–458*).—An account of cooperative experiments with commercial fertilizers, especially superphosphates, on soils in southwestern France poor in phosphoric acid. In this region Indian corn is the most important crop sown. The addition of phosphoric acid to increase the yield was quite uniformly successful.

Studies on the stand of plants in good and poor meadows, particularly in the hay district, R. BRAUNGART (*Fuhling's landw. Ztg., 14 (1895), No. 24, pp. 760–768; 45 (1896), Nos. 1, pp. 15–21; 2, pp. 46–53; 3, pp. 96–103; 4, pp. 132–135; 5, pp. 150–155; 6, pp. 187–191; 7, pp. 218–221*).

Culture of oats on a poor soil, L. GRANDEAU (*Jour. Agr. Prat., 60 (1896), I, No. 16, pp. 561–564*).—White Poland oats weighing 61.85 kg. per hectoliter were drilled in on 14 plats on a poor siliceous soil at the rate of 189 liters per hectare. The only fertilizer added was nitrate of soda 100 kg. (15 kg. of nitrogen) to the hectare. The yields are tabulated. The author concludes that it is possible to obtain in these poor soils returns from cereals comparable to those from soils long in culture and

mostly reputed fertile; and that natural phosphate of lime of the most diverse origin is assimilable.

Field experiments on oats in 1895 (*Agl. Students' Gaz., 7 (1896), No. 6, pp. 214-218*).—Twenty-four tenth-acre plats manured with kainit, ammonium sulphate, superphosphate, barnyard manure, and sodium nitrate, used singly and two by two, were sown to Black Tartarian oats April 10. The oats were cut August 19 and threshed August 28. The yields are tabulated and show an increased yield when nitrogen was applied (with phosphates) amounting to 9¾ to 12¼ bu. per acre.

The condition of potato culture and report on variety tests of new sorts of potatoes in 1895, VIBRANS (*Deut. landw. Presse, 23 (1896), No. 22, pp. 188, 189*).

Influence of the starch content of the seed tubers on the yield of tubers and starch, W. BLUMICH (*Sachs. landw. Ztschr., 1896, No. 9, p. 92*).

Growing potatoes, E. BURKE (*Amer. Hort., 6 (1896) No. 3, pp. 35, 36*).—A short article recounting cultural methods that have proved successful in Indiana.

Useful Australian plants, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, pp. 75-78, pl. 1*).—Notes are given on *Sorghum halepense*.

Analysis of the petioles of beet leaves, A. STIFT (*Bot. Centbl., 65 (1896), No. 2-3, p. 13*).—Analyses gave water 9.75 per cent, albuminoids 15.25, non nitrogenous matter 2.50, fat 3.18, starch and dextrin 0.80, pentoses, 11.06, other nitrogen-free extract 23.70, fiber 25.10, and ash 8.28.

A study on the food of the sugar beet, W. SCHNEIDEWIND and H. C. MÜLLER (*Jour. Landw., 44 (1896), No. 1, pp. 1-30*).—A study of the ash content of sugar beets grown with different fertilizers.

On the conditions of a profitable beet culture, especially the application of nitrate of soda to beets, as well as considerations on the most suitable manuring of other cultivated plants, MAERCKER (*Mitt. deut. landw. Ges., 11 (1896), No. 9, pp. 71-78*).—An address.

Tests of varieties of sugar cane, F. A. F. C. WENT and H. C. P. GEERLIGS (*Med. Proefstn. Suiker. West Java, No. 22, pp. 8, dgm 1*).—A report is made of tests of suckers from seedlings of 1893-'94 and of seedlings of 1894-'95.

On the improvement of sugar cane, J. H. WAKKER (*Bot. Centbl., 65 (1896), No. 2-3, pp. 37-43*).

Cane cultivation in the Straits settlements, F. CAMPEN (*Indian Agr., 21 (1896), No. 1, p. 24*).

Tobacco, P. BIERY (*Les Tabacs. Paris: Librairies Imprimeries réunies, pp. 278*).—This is a complete study on the botany, culture, and chemistry of tobacco; on the methods of manufacture of snuff, smoking and chewing tobacco, and on the physiological and therapeutic effects of these articles.

Experiments at Borsbeke lez-Alost, P. DE VUYST (*Rev. Agron., 4 (1896), No. 4, pp. 337-372*).—The results of 3 years' work are given with reference to the analysis of the soil by the plant, variety test of potatoes, experiments on the best mixtures of seed for meadows, and effect of different applications of fertilizers on potatoes and turnips.

Field experiments on hay, pasture, potatoes, swedes, and mangels (*Second Annual Rpt. University Extension College, Reading, England, pp. 3-29*).—This is a report on coöperative experiments carried on in Berkshire, Hampshire, and Oxfordshire under the direction of the University Extension College. The experiments include a 5-year test of the effect on pasture of one application of manure; the effect of mineral manures on meadow and pasture; the seeding of land for hay or pasture to remain 4 or 5 years; the culture of potatoes, swedes, and mangels; and rotation experiments. On account of the unusually dry season the results were unsatisfactory.

Cultural experiments on the academic trial field at Poppelsdorf (conclusion), THIELE (*Ztschr. landw. Ver. Rheinpreussen, 13 (1896), No. 8, pp. 62-64*).—Notes with tabulated data are given for variety tests of fodder beets and yield and sugar content of sugar beets.

The Nagapore experimental farm, J. W. LEATHER (*Agl. Ledger, 1895, No. 14, pp. 14*).—This farm consists of 90 acres of "black cotton soil." The best paying variety of cotton tested is the Upland Georgian. Sorghum and maize are also grown experimentally, and the action of different manures are investigated, especially that of night soil.

Silos and silage, W. J. SPILLMAN (*Washington Sta. Bul. 14, pp. 19, figs. 4*).—A popular bulletin on the subject, mainly compiled, treating of the crops suitable for silage, their growth and storage, and the construction of silos, with illustrations. The following varieties of corn are recommended to farmers in the State as suitable for silage: Stowell Evergreen, Minnesota Dent, Leaming, Sibly Pride of the North, Southern Ensilage, and Southern Horse Tooth.

Distribution of seeds and plants, E. J. WICKSON (*California Sta. Bul. 109, pp. 16, pls. 3*).—A descriptive list is given of plants for green manuring, forage plants, trees, tobacco, sugar cane, Persian grapes, grains, and garden seeds that are offered to citizens of the State.

HORTICULTURE.

Peach growing for market, E. F. SMITH (*U. S. Dept. Agr., Farmers' Bul. 33, pp. 23, figs. 21*).—This bulletin gives general directions on the subject, and is intended for persons contemplating the culture of peaches rather than for those already successfully raising the crop. A climate not liable to violent extremes of any sort and with an annual rainfall of from 36 to 50 in. is considered best, and a well drained sandy or loamy soil with clay subsoil is recommended, although peaches are grown successfully on almost all soils. A northern exposure within easy reach of large markets is best, and the land should be prepared for planting by careful plowing. The trees should be planted 20 by 20 ft., and such varieties selected as have been shown by experience to thrive in that region.

The following varieties are recommended as profitable for market orchards: Alexander, Amsden, Troth, Rivers, Louise, Hale, St. John, Mountain Rose, Crawford Early, Foster, Old Mixon, Stump, Elberta, Crawford Late, Reeves, Wager, Fox Seedling, and Beers Smock. Shallow spring plowing, followed by frequent clean cultivation until July, is urged. Trees may be pruned with heads of different heights, but a spreading or vase shaped top is usually preferred by most large growers. Annual manuring with well-composted barnyard manure combined with clover and commercial fertilizers is usually necessary.

Illustrated remarks are made upon the nature and treatment of the following diseases and insects: Peach yellows, peach rosette, peach mildew, peach curl, black spot, rot, crown galls, root knot, root borers, pin borers, aphides, curculio, and scale insects. The use of sprays and washes is advised, but care should be taken that weak solutions be used to avoid injuring the trees.

Directions are given for picking and marketing the fruit, careful and attractive packing being considered of great value for securing good prices. Care must be taken in distributing the crop to avoid gluts in the market, and intelligent management in all respects is insisted upon.

Strawberries, M. H. BECKWITH (*Delaware Sta. Bul. 28, pp. 16*).—This comprises descriptive notes and tabulated data for 71 varieties

grown at the station, Bubach, Brandywine, Greenville, Haverland, Meek, Michel, and Phillips being considered best for market and profit, and Beverly, Bomba, Brandywine, Eureka, Greenville, Meek, Michel, and Sharpless for home use. Descriptive notes are also given on the new varieties Ideal and Oriole grown in the State and which are regarded as promising.

Tabulated data are given showing the opinions of 20 growers throughout the State on the best varieties to be grown in Delaware, Bubach appearing to be the variety generally preferred and Haverland taking second place. Gandy is preferred for shipping and Sharpless for home use. Michel and Haverland are the most popular early varieties, with Gandy and Enhance for late berries.

Notes are given on the extent of injury from leaf blight and strawberry weevil throughout the State, Michel suffering the most, followed by Beder Wood, Cumberland, and Sharpless. Spraying with Bordeaux mixture where tried was found to give good results and is recommended. The strawberry weevil (*Anthonomus signatus*) caused but little injury, and it is believed that the pest can be kept in check by mowing and burning over strawberry fields after the fruit is picked.

Forcing strawberries under glass, R. WILLIAMSON (*Amer. Gard., 17 (1896), No. 62, pp. 129, 130*).—Cultural directions for the greenhouse growing of strawberries so as to have ripe fruit in March. It is stated that the plants to be used for the purpose should be from runners, grown in early summer from plants that were not allowed to set fruit, thus producing early and vigorous runners. In July the young plants should be placed in 3 inch pots filled with rich, light loam, and carefully watered until the pots are filled with roots, when the plants should be transferred to 6 inch pots. Beginning in September, water should be gradually withheld, and the plants placed in a greenhouse with the beginning of cold weather, although a few freezes do little if any damage. After the plants are "matured" by this system of drought, they may be watered again, and in December kept at a night temperature of 50 to 55° F. until ready to flower, when the temperature should not be allowed to fall below 60° F. The blossoms must of course be fertilized by hand, and such varieties employed as have perfect flowers, Belmont giving best results, although Jessie, Sharpless, and Marshall can also be grown under glass. Only the flowers that set well should be allowed to mature, and during the period of ripening the plants should be abundantly watered with sheep-manure water. A yield of as much as 30 qts. from 100 plants has been obtained.

Grape culture, H. N. STARNES (*Georgia Sta. Bul. 28, pp. 231–294, figs. 50*).

Synopsis.—This bulletin is an extended treatise upon the subject, embracing subdivisions upon the vineyard, propagation, planting, pruning and training, subsequent processes, diseases and insects, wine making, varieties, and imperfect pollination.

The vineyard (pp. 231–233).—Introductory remarks are made upon grape growing in Georgia, which is outranked in importance by but 2

horticultural products, peaches and watermelons. It is urged that care be taken in the location of the vineyard, as upon this and the soil much depends. A high mean temperature and a low mean rainfall during the spring with a moderate temperature and minimum rainfall during summer are the best meteorological conditions, and are found in various portions of the State, local surroundings affecting their existence. A warm, dry, loose, well drained soil well supplied with phosphoric acid and potash and with a strong clay subsoil is said to be the best for growing grapes; and thorough drainage is insisted upon. Good peach and cotton land with southern or western exposure, preferably the former, is recommended for grapes.

For profit in grape raising proximity to a railroad station is stated as an absolute necessity to avoid injuring the fruit by long carriage to the cars.

Propagation (pp. 233–239).—Three methods of propagation are described and illustrated; by cuttings, layers, and grafting. The cuttings should be from 8 to 12 in. long. Single joint and mallet cuttings and cuttings with more than one joint are figured, directions being given for their planting. Varieties of the *labrusca* and *vulpina* types are mentioned as available for this means of propagation, while grapes of the *æstivalis* and *rotundifolia* types must be layered for successful propagation. In spite of the tedious and difficult nature of vine grafting, it is recommended that the operation be performed, as by this means it is possible to replace a worn-out vineyard in one season by thrifty growth of vines. Directions are given for cleft grafting, whip grafting, and marching in spring, and cleft grafting in fall.

Planting (pp. 239–252).—The first subject treated under this head is the preparation of the soil, 2 thorough plowings and harrowings being urged. Before breaking the land it is recommended that all rolling portions should be terraced. As distances for planting the vines 12 by 6 ft. is given for staked grapes and 10 by 8 ft. when the vines are to be trellised. In terraced land on uneven hillsides a flare system should be used in laying off the rows, as by this means their appearance is improved. Wide, moderately deep holes are advised, the surface soil being sifted round the roots and the lower soil mixed with fertilizers and used to fill in the remainder of the hole. Complete fertilizers are stated to be the best, only a small portion of nitrogen, however, being necessary in proportion to the amount of phosphoric acid and potash applied. More nitrogen should be applied the first year than in succeeding seasons. The following formula is given for a permanent fertilizer, to be applied at the rate of 3 lbs. per vine:

	Pounds
High grade acid phosphate	900
Kainit	900
Cotton-seed meal	200

A top dressing of unleached wood ashes, 1,000 to 2,000 lbs. per acre, applied in the spring, is suggested.

The best time for planting in Georgia is stated as early winter, from the first of December to Christmas, 1-year vines to be employed on account of their possessing a smaller root system to be disturbed. The cultivation should be shallow, and between the rows of grapes the first year a single row of cowpeas may be planted. The lateral shoots on the vines should be pinched off the first season to throw all the force of the roots into the main shoot.

Staking the vines is not advised, trellising being preferred; but where stakes are employed they should be of chestnut or post oak, with the ends charred or soaked in gas tar before driving to preserve them from insects and mold as long as possible. For trellising, posts set 24 ft. apart, connected by from 2 to 4 wires, about No. 10, are recommended, and directions are given for constructing and setting the posts and their braces.

Pruning and training (pp. 252–274).—This branch of grape culture is given considerable space and treated at some detail, the growth of the vine being briefly described to begin with. Three systems of pruning and training are discussed: (1) Horizontal renewal, comprising 2 and 4 cane renewals, spur renewal, fan system, and block system; (2) drooping system, comprising the true or 4-cane Kniffin, umbrella or 2-cane Kniffin, low or single-wire Kniffin, Caywood or arbor system, Munson system, and post or stake system; and (3) the system of horizontal training. The fan, 4 cane Kniffin, and modified Munson are the methods preferred by the author. Judicious pinching of the leaves from April until June is recommended as producing a thick, leathery foliage that aids in producing the sugar needed in ripening the berries.

Subsequent processes (pp. 275–280).—Under this head are treated the subjects of sacking, gathering, packing, marketing, and preservation. Sacking is recommended where grapes are grown on a small scale, though it is thought to be hardly profitable in a large commercial vineyard. In gathering the grapes pruning shears or patent grape pickers are preferred to knives. It is urged that the bunches be allowed to wilt before they are packed, and that during the process they be overhauled, and unripe, decayed, and burst berries be removed with scissors and the bunches divided into 2 grades. Packing in 5 or 10 pound baskets with the stems down and 2 layers to the basket is recommended.

Grape growers are cautioned to carefully select the commission dealers with whom they place their crops, and to be judicious about shipping to an already glutted market.

Brief mention is made of the method of preserving grapes for some time by exposing them in an air tight receptacle to the vapor of alcohol at a cool, uniform temperature.

Diseases and insects (pp. 280–286).—Descriptive notes are given on the black rot (*Læstadia bidwellii*), brown or downy mildew (*Peronospora viticola*), powdery mildew (*Uncinula ampelopsidis*), anthracnose, root rot (*Dematophora necatrix*), bitter rot (*Greeneria fuliginea*), white rot, ripe rot (*Glœosporium fructigenum*), and grape leaf blight, and the

most efficient remedies for the different diseases are named. Directions are given for the preparation and application of Bordeaux mixture and modified eau celeste.

Brief life history and remedial notes are given on some grape insects, the phylloxera, root borer, grape curculio, and berry moth being considered of most importance.

Wine making (pp. 287–289).—Brief directions are given for the manufacture of wine, the principles underlying the process being condensed in the advice: "Reënforce the alcohol and dilute the acid." The directions embody notes on the making of medicinal wine, claret, sauterne, and sherry. The process of fermentation is briefly discussed and the importance of thoroughly cleansing used casks is dwelt upon.

Varieties (pp. 289–292).—The following varieties are recommended for various purposes: For shipping, Moore Early, Delaware, Ives, Niagara, Concord, and Carman; for table or local market, Presly, Green Mountain, Bell, Moore Early, Brighton, Delaware, Ives, Brilliant, Empire State, Niagara, Concord, Goethe, and Carman; for white wine, Goethe, Missouri Riesling, Elvira, Catawba, Herbemont, Delaware, and Scuppernong; for red wine, Norton Virginia, Cynthiana, Cunningham, Ives, Concord, and Thomas; for sherry, Hermann and Rulander.

Imperfect pollination (pp. 292–294).—The botanical side of the pollination of grapes is briefly discussed and figures given of flowers with abortive pistils, and of flowers with erect and with reflexed stamens. Lists are given of the varieties grouped with reference to the condition of their stamens.

Horticulture in Oregon, J. R. CARDWELL, H. E. DOSCH, J. MINTO, C. L. DAILEY, and E. SCHANNO (*Oregon State Bd. Hort. Bul. 9, pp. 61, pls. 7, figs. 2*).—This publication contains articles by the several authors on various horticultural topics, comprising the preparation of sprays, a spray calendar, planting table, the pollination of pears, improvement of old orchards, orchard culture, fungi, fruit growing in Oregon, and strawberries. The bulletin is prefaced by a quotation of the Oregon horticultural laws and quarantine regulations.

Asparagus as a money crop (*Amer. Agr. (middle ed.), 1896, Apr. 4, p. 386; Apr. 11, p. 417*).

Asparagus, T. D. HATFIELD (*Garden and Forest, 9 (1896), No. 425, p. 177*).—Cultural notes, with remarks on European methods, and directions for winter forcing under glass.

Forcing asparagus in brick pits, G. WYTHES (*Field, Farm, and Garden, 87 (1896), No. 2256, p. 454*).—Cultural directions, leaves being recommended for heat and watering with liquid manure regarded as important.

Celery oil (*Amer. Hort., 6 (1896), No. 3, p. 41*).—A brief note on this essential oil, which has been recently distilled in Germany. One thousand pounds of the leaves are required to yield 1 lb. of the oil, which has a powerful aromatic odor and taste.

Cucumber growing (*Jour. Hort., 1896, No. 2478, pp. 281, 282*).—Brief directions for growing cucumbers in hothouses in England.

Mushrooms for profit (*Garden, 49 (1896), No. 1270, p. 206*).—General directions for growing.

Muskmelon culture (*Amer. Hort., 6 (1896), No. 3, p. 36*).—Brief notes on the cultivation, particularly in reference to starting the seedling plants in early spring, muslin-covered frames being recommended.

Culture of onions (*Jour. Hort., 1896, No. 2475, pp. 208–210*).—Popular directions for cultivation.

Pepper in India, J. C. SAWER (*Indian Agr., 21 (1896), No. 2, pp. 62, 63*).—The fruit is borne in long clusters of from 30 to 50 berries, on a vine which bears in 3 years after being planted. The vines find their support on tree trunks, at the bases of which they are planted. The fruit is picked when the berries are full grown, but before they are ripe, when they begin to change from green to red at the base. The berries are fit for sale when dry. "White pepper" is from the fruit allowed to ripen before picking and is not as pungent.

Cultivation of rhubarb, C. W. MURIFELDT (*Amer. Hort., 6 (1896), No. 3, p. 35*).—A brief popular article on the culture of this vegetable.

The forced culture of rhubarb, E. ANDRÉ (*Jour. Agr. Prat., 60 (1896), No. 12, pp. 434–436, fig. 1*).

Two ways of growing tomatoes, W. W. TRACY (*Rural New Yorker, 55 (1896), No. 2411, pp. 254, 255*).—Compares two fields, in one shallow cultivation and coarse manure being employed, and in the other deep culture and well-rotted manure. The first method gave much the best yield.

Tomatoes not setting, E. C. GREEN (*Amer. Gard., 17 (1896), No. 67, p. 179, fig. 1*).—Directions for pollenizing tomatoes by jarring the pollen into a teaspoon, into which the pistils may be dipped.

The frame in plant culture, E. A. LONG (*Amer. Gard., 17 (1896), No. 68, pp. 227, 228, fig. 1*).—Recommends placing plants temporarily in frames instead of removing them directly from the greenhouse to the open ground.

Market gardening under glass, W. W. RAWSON (*Amer. Gard., 17 (1896), No. 66, pp. 196, 197, fig. 1*).—Notes on buildings, manures, the use of electric lights, and on the culture of asparagus, beets, radishes, dandelions, and lettuce.

Heating greenhouses, L. R. TAFT (*Florists' Exchange, 8 (1896), No. 15, p. 379*).—Directions for heating both with steam and hot water.

Gardening in Lucknow, J. O. MILLER (*Indian Agr., 21 (1896), No. 2, pp. 61, 62.*

Kei or Kafir apple (*Trans. Queensland Acclimat. Soc., 1 (1896), No. 12, p. 220*).

Improved apple cultivation, S. J. RUTHERFORD (*Garden, 49 (1896), No. 1270, pp. 213, 214*).—Directions for improved methods, tillage being insisted upon.

Apricots in heavy soil (*Garden, 49 (1896), No. 1270, pp. 210, 211*).—A well-drained soil is preferred.

Apricots as cordons, R. PARKER (*Garden, 49 (1896), No. 1270, pp. 212, 213*).—Directions for growing apricots against walls and urging their more extensive culture in England.

Frost protection to orange orchards (*California Fruit Grower, 18 (1896), No. 6, p. 110*).—It is believed to be impracticable to create a fog blanket over orchards.

Seedling pineapples (*Trans. Queensland Acclimat. Soc., 1 (1896), No. 12, p. 219*).

The shaddock, grape fruit, and forbidden fruit, C. H. LOWELL (*Amer. Jour. Pharm., 68 (1896), No. 8, pp. 121–130, pls. 2*).

Establishing an orchard—setting out and pruning the trees, T. G. YEOMANS (*Cult. and Country Gent., 66 (1896), No. 2254, p. 288*).—The author shows how trees can be set in perfect rows with the use of few stakes, and describes the method of pruning trees when set out.

Food requirements of orchards, E. B. VOORHEES (*Amer. Gard., 17 (1896), No. 69, pp. 250, 251*).—Extracts from a lecture on the subject showing the necessity of studies and investigations concerning the food requirements of the various fruits. Brief directions for the application of general fertilizers are given.

Handbook of fruit tree culture, II (*Handbuch der Obstcultur. Berlin: P. Parey, pp. 64*).—This is the second of a series of numbers to be issued on this subject.

Red and white currants (*Garden, 49 (1896), No. 1272, p. 256, fig. 1*).—A general article giving cultural directions.

The Japanese wineberry, B. C. BUFFUM (*Amer. Gard., 17 (1896), No. 69, p. 242, fig. 1*).—This berry is not advised for market, but strongly recommended for home use, and the flavor is highly praised.

Loss of vine roots, W. IGGULDEN (*Garden, 49 (1896), No. 1267, p. 147*).—Advises against mulching with manure litter, especially if covered with compost, as the new roots induced rapidly rot.

The reëstablishment of vineyards in Loir-et-Clur, H. BLIN (*Jour. Agr. Prat., 60 (1896), No. 9, pp. 316–319*).

Manuring of grapes and quality of the wine (*Deut. landw. Presse, 23 (1896), No. 2, pp. 180, 181*).

Keeping vines clean, W. IGGULDEN (*Garden, 49 (1896), No. 1270, pp. 209, 210*).—Urges the spraying of grapevines in houses to prevent attacks of insects.

The cultivation of vines under glass, J. P. LEADBETTER (*Jour. Hort., 1896, No. 2478, pp. 276, 277*).—A paper giving directions for proper houses, soil, planting, manuring, and pruning, and recommending the varieties Black Hamburgh, Buckland Sweetwater, Madresfield Court, and Muscat of Alexandria.

A handbook of table grape culture, R. GOETHE (*Berlin: P. Parey, 1894, pp. XII, 235, figs. 150, pls. 30*).

American vine culture, C. MAYER (*Agl. Jour. Cape Colony, 9 (1896), No. 4, pp. 77–79.*)—An article treating of the cultivation of American vines in Europe.

Spring protection of fruit trees, E. BURRELL (*Garden, 49 (1896), No. 1271, p. 226*).—The use of two or more thicknesses of half inch-mesh netting is recommended to English gardeners for protecting blossoming trees from frosts and cold rains or sleet during early spring

Fruits under glass, W. POPE (*Gard. Chron., 19 (1896), No. 483, p. 297*).—Short cultural notes on pineapples and cucumbers.

Tropical fruit trees, B. F. HERRICK (*Pop. Sci. Monthly, 48 (1896), No. 6, pp. 751–758, figs. 6*).

New England fruit, A. H. BENSON (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 899–904*).

How to graft, A. S. FULLER (*Amer. Gard., 17 (1896), No. 67, p. 71, figs. 2*).—Popular directions for cleft and splice grafting.

The improvement of fruit trees by grafting (*Deut. landw. Presse, 23 (1896), Nos. 23, p. 197; 25, p. 217, figs. 4*).

Pruning vines at the articulations, G. BELLAIR (*Rev. Hort., 68 (1896), No. 4, pp. 80, 81, figs. 3*).—Advocates this method, as preventing the entrance of air and water into the stem.

The pruning of shrubs, E. A. LONG (*Amer. Gard., 17 (1896), No. 63, p. 149, fig. 1*).—Brief suggestions for artistic pruning.

Pruning shrubs, G. A. HENRY (*Garden and Forest, 9 (1896), No. 425, pp. 176, 177*).—A brief note on pruning for foliage and flowers.

Suggestions on tree pruning, E. A. LONG (*Amer. Gard., 17 (1896), No. 65, pp. 180–187, figs. 2*).—Brief notes, long stumps being condemned.

Culture of hollyhocks (*Jour. Hort., 1896, No. 2478, pp. 272, 273*).—Brief notes on the growing of these flowers, which are recommended for back lines to broad flower borders.

Soil for roses, R. SIMPSON (*Amer. Florist, 11 (1896), No. 408, pp. 911, 912*).—A brown or yellowish loam, inclined to clay rather than to sand, is preferred

Sowing sweet peas, G. ARNOLD and W. T. HUTCHINS (*Amer. Florist, 11 (1896), No. 408, pp. 914, 915*).—This is a joint controversial article on the proper depth to plant sweet peas, it being urged that too great a depth must be avoided and yet the seed planted deep enough for the roots to stand summer droughts.

The essentials of a good lawn, J. TROOP (*Garden and Forest, 9 (1896), No. 420, p. 106*).—A short suggestive article, deep soil, proper kinds of grass, frequent mowing, and plenty of water being stated as essential requisites.

Some native ornamental grasses, T. H. KEARNEY (*Garden and Forest, 9 (1896), No. 425, pp. 152, 153*).

Plant more oak trees, E. A. LONG (*Amer. Gard., 17 (1896), No. 66, pp. 194, 195, fig. 1*).—Strongly recommends oaks for ornamental grounds and gives illustrations of the laurel oak and willow oak.

Oaks for ornament, E. A. LONG (*Amer. Gard., 17 (1896), No. 67, pp. 212, 213, figs. 2*).—Illustrated descriptive notes on some species desirable for planting in grounds.

Physalis franchetti (*Garden, 49 (1896), No. 1271, p. 232, col. pl. 1, figs. 2*).—A brief descriptive and cultural note on this Japanese winter ground-cherry, which is admired for its large brilliant orange-scarlet calyces.

FORESTRY.

Rate of growth of the long-leaf pine, A. K. MLODZIANSKY, (*Garden and Forest, 9 (1896), No. 417, pp. 72, 73*).—The author gives the results of the measurement of 65 trees of the long leaf pine *Pinus palustris*, to ascertain the rate of its growth. For the first 7 or 8 years the growth in height is said to be very slow. From the seventh or eighth to the thirtieth to the thirty-fifth year annual rate of growth is 16 to 17 in. The tree reaches its full height in 90 to 100 years, when it measures about 80 ft. in height. Growth after this time is very slow, trees 225 to 300 years old attaining a height of from 108 to 118 ft.

Growth in diameter is rapid for the first 30 years, the stems thickening about 1.6 in. per decade. For the next 50 years the rate of diameter accretion is 1.4 in. per decade. At this time the tree will be about 13 in. in diameter 4 ft. from the ground. From 80 to 140 years the rate of growth in diameter gradually decreases, after which the diameter accretion falls rapidly, not exceeding 0.3 to 0.4 in. per decade.

The rate of mass accretion is rather gradually increased for about 140 years, when a decrease is noticed. Of course much will depend upon the soil, moisture, climatic, and forestry conditions under which the trees grow.

The mass of a tree not only increases with age but the value increases on account of the greater size of boards produced. As now understood, a period of about 200 years is considered as the most economical rotation for the long leaf pine.

The value of proper forest management is shown in the effect of light upon the rapid and perfect development of the trees, this tree in the rate of its growth being very sensitive to light conditions. The difference is shown in the example of trees 140 to 160 years old. A tree in a dense forest forms a log containing 67 to 82 cubic feet, but one of the same age in an open forest will produce 148 to 177 cubic feet in the log. The same trees would increase in volume for the next 20 years 16 cubic feet if in a dense forest, while with plenty of light in 11 years the increase would be 36 to 37 cubic feet.

Tree temperatures, R. W. SQUIRES (*Minnesota Bot. Studies, Bul. 9, pt. 7, pp. 152–159*).—The author reports upon a series of observations taken of the internal temperature of a box-elder tree. The period covered extended from January 15 to June 3, 1894, 3 readings being taken daily. In general the temperature of the tree was lower than the air in the morning and at noon, but was higher in the evening. The lowest tree temperature recorded was —21.1° C. The temperature of the air at the same time was —25°.

The mean temperature of the tree was 1.31° higher than the air for January, practically the same during February, 1° lower in March, 0.85° higher in April, and 1.13° lower in May. The relatively high temperature for April, the author thinks, was in part due to the metabolic activity at that time.

Timber, F. ROTH (*U. S. Dept. Agr., Division of Forestry Bul. 10, pp. 88, figs. 49*).—This bulletin is an elementary treatise on the characteristics and properties of wood, particularly of American varieties. Illustrated notes are given on the structure and appearance, weight, moisture, shrinkage, mechanical properties, chemical properties, and durability and decay of various kinds of timber. Practical suggestions are offered as to the relative values of various woods for different uses. A key is given by which it is possible to distinguish the more common kinds of wood grown in the United States. The structural differences selected are such as may be visible to the naked eye, or with a magnifier, occasional recourse being had to the compound microscope. As a portion of the key an alphabetical list is given of the more important woods of the United States, in which 116 kinds are briefly described and some of their more conspicuous uses mentioned. In the preparation of the key the author was aided by B. E. Fernow.

The bulletin will no doubt be found of value to engineers, architects, lumbermen, and others, for whom it was primarily intended.

Some foreign trees for the Southern States (*U. S. Dept. Agr., Division of Forestry Bul. 11, pp. 32, pls. 3*).—A report is given on cork oak by J. D. Jones, wattles by C. A. Keffer, eucalyptus by A. Kinney, and bamboo by H. G. Hubbard.

Notes are given on the history of these various trees, methods of cultivation and preparation for market, and uses in their native homes, with suggestions as to their probable value as additions to the forest flora of the southern portion of the United States.

The rust of the deciduous Antarctic beech, F. NEGER (*Forstl. naturw. Ztschr., 5 (1896), No. 2, pp. 69–71*).—Notes are given on *Melampsora fagi*.

Fusicladium betulæ upon birch leaves, R. ADERHOLD (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 2–3, pp. 57–59*).—The author describes as a new species this fungus formed upon birch leaves.

Ai camphor (*Roy. Gard. Kew, Bul. 107, pp. 275–277, pl. 1*).—Botanical description of *Blumea balsamifera*, with notes on the preparing of the camphor by boiling the young leaves and ends of the branches in water. The camphor is distilled into vessels, where it crystallizes.

On the distribution of white cedar in New Jersey, J. GIFFORD (*Garden and Forest, 9 (1896), No. 416, p. 63*).—Notes are given of the distribution of *Cupressus thyoides* within the State.

The box elder on the plains, C. E. BESSEY (*Garden and Forest, 9 (1896), No. 418, p. 83*).—Notes are given on this tree, which is considered by the author as very desirable for this region.

Investigations on the growth of firs, R. HARTIG (*Forstl. naturw. Ztschr., 5 (1896), No. 1, pp. 1–15, figs. 6*).

Douglas fir, W. SCHLICH (*Gard. Chron., ser. 3, 19 (1896), No. 479*).—The author states that for 6 years he has been growing seedlings of this plant, getting from 8,000 to 10,000 from a pound of seed.

Insect injury to fir, seedlings, TUBEUF (*Forstl. naturw. Ztschr., 5 (1896), No. 2, pp. 75, 76*).

Concerning the effect of sulphurous acid on the health of fir trees, R. HARTIG (*Forstl. naturw. Ztschr., 5 (1896), No. 2, pp. 65–69*).

Propagating hickories, J. DAWSON (*Garden and Forest, 9 (1896), No. 417, pp. 77, 78*).—The preferred method is by grafting pot or box grown stocks of the bitternut (*Hicoria minima*), and the operation is described.

The bitternut hickory, J. T. ROTHROCK (*Forest Leaves, 5 (1895), No 6, p. 89, pls. 2*).—Brief descriptive note of the bitternut hickory, with half-tone illustrations of a large tree and of its trunk.

Juniperus communis, N. J. ROSE (*Garden and Forest, 9 (1896), No. 421, p. 114*).—Notes are given upon the characteristics and growth of this tree.

Larch disease (*Gard. Chron., ser. 3, 19 (1896), No. 481, p. 337*).—Brief popular notes upon the spread and extent of injury done trees by this disease.

On the occurrence of Sphærella laricina on the Japanese larch, R. HARTIG (*Forstl. naturw. Ztschr., 5 (1896), No. 2, p. 74*).—The author mentions the occurrence of this fungus on 3 year-old specimens of *Larix leptolepis*.

The limes, W. J. BEAN (*Gard. Chron, 18 (1895), No. 470, pp. 764–766*).—Descriptive and synoptic notes on various species and varieties of lindens (Tilia), it being stated that there are 11 European, 5 American, and 6 Asiatic.

Investigations concerning the wood of the red oak, F. EICHHORN (*Forstl. naturw. Ztschr, 4 (1895), No. 6, pp. 233–261; No. 7, pp. 281–290; abs. in Bot. Centbl., 64 (1895), No. 4, pp. 137–139*).

The one-leafed Scotch pine, A. D. WEBSTER (*Gard. Chron, ser. 3, 19 (1896), No. 474, p. 105*).—Notes are given on *Pinus sylvestris monophylla*.

Investigations on the growth of pines, R HARTIG (*Forstl. naturw. Ztschr., 5 (1896), No. 2, pp. 33–47*).

Pinus palustris, E. S BASTIN and H. TRIMBLE (*Amer. Jour. Pharm., 68 (1896), No. 3, pp. 136–140*).—A continuation of the contribution to the knowledge of North American coniferæ. The present paper deals with the chemistry and the physiology of the resins.

A pine coppice, B. E. FERNOW (*Garden and Forest, 8 (1895), No. 405, pp. 472, 473*).

A contribution to the knowledge of some North American coniferæ, E. S. BASTIN and H. TRIMBLE (*Amer. Jour Pharm., 68 (1896), No. 1, pp. 1–39, pl. 1, figs. 7*).—The first of a series of studies on the botany, histology, chemistry, and economics of the conifers, *Pinus strobus* being the subject of the present paper.

Plane trees (*Garden and Forest, 9 (1896), No. 417, pp. 71, 72, pl. 1*).—An editorial article upon the plane trees of North America.

Evergreen poplar (*Gard. Chron., ser. 3, 19 (1896), No 841, p. 532*).—A brief statement is given of the presence of an evergreen poplar in Paris. The tree is thought to have come from Chile.

Sumach (*Roy. Gard. Kew, Bul. 107, pp. 293–294*).—A brief report on *Rhus coriaria* as grown in Palermo, about 25,000 tons having been exported in 1894. The leaves are stated to contain about 20 per cent of gallo-tannic acid.

Report on turpentine timber with reference to its resistance to teredo, J. H. MAIDEN and J. V. DECOQUE (*Agl. Gaz. N. S. Wales, 6 (1895), No. 11, pp. 735–743*).—The authors conclude that this timber (*Syncarpia laurifolia*) is not absolutely resistant to teredo, but is more resistant when the bark is intact.

Methods of protecting the banks of streams, A. RONNA (*Jour. Agr. Prat., 59 (1895), No. 46, pp. 698–702, pls. 6*).—Protection by means of planting willows, etc., is recommended.

Osier culture, F. VON FOERSTER (*Die Korbweidencultur und ihr Werth für die Landwirtschaft der östlichen Provinzen Preussens. Berlin: Paul Parey, 1895*).

Notes on arborescent willows, IV, M. S. BEBB (*Garden and Forest, 8 (1895), No. 405, p. 473*).

Notes on arborescent willows of North America, V, M. S. BEBB (*Garden and Forest, 8 (1895), No. 406, pp. 482, 483*).—*Salix piperi* is described as a new species.

Relations of Salix missouriensis to S. cordata, N. M. GLATFELTER (*Trans. St. Louis Acad. Sci., 7 (1895), No. 5, pp. 137–144, pls. 3*).—The author concludes that these 2 species of willow are identical.

Trees of minor importance for western planting, F. A. WAUGH (*Garden and Forest, 9 (1896), No. 414, pp. 42, 43*).—Notes are given on the Russian mulberry, sycamore, and hackberry.

Botanical notes, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 6 (1895), No. 10, pp. 680–682*).—Notes are given on the following Australian trees: *Doryphora sassafras, Gmelina leichhardtii,* and *Araucaria cunninghamii.*

Forest trees and shrubs, XII, G. HEMPEL and K. WILHELM (*Wien: Holzel, pp. 65–88, pls. 3*).

Forest fires and how to extinguish them, H. N. JARCHOW (*Forester, 2 (1896), No. 2, pp. 21–23*).

Value of forests (*Forester, 2 (1896), No. 2, pp. 20, 21.*)—A report is given of two lectures delivered at Trenton, New Jersey, January 15, 1896, one by J. T. Rothrock on "The relation of forests to the surface of the country," the other by J. Gifford on "Damage from forest fires in New Jersey in 1895."

Forest tree planters' manual, J. O. BARRETT (*Forester, 2 (1896), No. 2, p. 23.*)—This publication is issued by the Minnesota Forestry Association, the author being secretary of that body.

Forestry planting and horticulture in Jutland, V. RIEDEL (*Tidskr. Landokon., 14 (1895), pp. 722–731*).

Notes upon the commercial timbers of New South Wales, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 815–819*).—Notes are given of the value, distribution, characteristics, and especial uses of the timber of this region.

Forestry notes, A. C. FORBES (*Gard. Chron., ser. 3, 19 (1896), No. 477, p. 200*).—Brief notes are given on the Douglas fir, on *Thuya gigantea*, etc., for introduction into the forests of England.

Forestry studies—the pineries, J. CREVAT (*Jour. Agr. Prat., 60 (1896), Nos. 3, pp. 87–90; 4, pp. 132–137; 6, pp. 204–207*).—Notes are given upon the management of pine forests, especial attention being given to the subject of thinning.

The forests of North Carolina (*Forester, 2 (1896), No. 2, pp. 28–30*).—A review is given of Bulletins 5 and 7 of the North Carolina Geological Survey. The first on forests, forest lands, and their products, and the second on forest fires.

Forest conservation, W. MACDONALD (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 844–849*).

Forest protection, G. PINCHOT (*Garden and Forest, 9 (1896), Nos. 418, pp. 87, 88; 419, p. 99; 421, pp. 118, 119*).—Notes are given of various injuries suffered by forest trees and suggestions for their prevention.

Some new useful trees, H. HITIER (*Jour. Agr. Prat., 59 (1895), No. 41, p. 535*).

Trees and their growth, W. WICKHAM (*Gard. Chron., ser. 3, 19 (1896), No. 476, p. 169*).—A list is given of 11 trees that show an annual increase of 1 in. or more in girth 4 ft. from the ground.

Distribution of tree roots (*Gard. Chron., ser. 3, 19 (1896), No. 475, pp. 145, 146*).

On the occurrence of Agaricus melleus in deciduous forests, A. CIESLAR (*Forstw. Centbl., 22 (1896), No. 1, pp. 19–26, figs. 1*).

A new disease of larch leaves, E. MER (*Compt. Rend., 121 (1895), No. 25, pp. 964–967*).

Forest lands in Massachusetts, C. S. PLUMB (*Garden and Forest, 9 (1896), No. 415, p. 52*).

The reforestation of woodland areas, C. E. CURTIS (*Jour. Roy. Agl. Soc. England, 6 (1895), No. 24, pp. 276–288*).—Recommendations for tree planting in forest lands, so as to maintain a continuous sequence of trees.

Sample hedges on the Central Experimental Farm (*Canada Exptl. Farms Rpt. 1894, pp. 36–41*).—These are notes on the various species of trees and shrubs tested as

regards their value for hedges, and consist of an annotated list of the 30 species of both deciduous and evergreen plants employed.

Forestry at the Northwest Territory Experimental Farm, A. MACKAY (*Canada Exptl. Farms Rpt. 1894, pp. 372–378, fig. 1*).—Notes on various forest trees and shrubs grown as windbreaks and hedge plants and for ornament on the experimental farm. The experience has been that trees can be grown successfully on the most exposed situations, and brief directions are given for successful tree culture.

Report of the foreman of forestry, W. T. MACOUN (*Canada Exptl. Farms Rpt. 1894, pp. 51–53*).—Report on the progress of the division of forestry and ornamental grounds, methods and conditions and value of the trees being briefly treated.

A German view of the value of the forest (*Garden and Forest, 9 (1896), No. 416, p. 61*).—Quotations and editorial comments are given of a recent address by F. Bauer on the subject of forestry.

What is the forest policy of European nations? B. E. FERNOW (*Garden and Forest, 9 (1896), No. 413, pp. 33, 34*).—Notes are given as to the degree to which the forest domain has been extended in France, Prussia and other German States, Italy, Austria, Russia, and India. The author pleads for a national policy for this country.

Forestry, A. NEERGAARD (*Skovbruget. Copenhagen: P. G. Philipsen, 1895, figs. 70*).

The Minnesota Forestry Association (*Garden and Forest, 9 (1896), No. 413, p. 39*).—A brief report is given of the annual meeting held at Minneapolis, January, 1896.

SEEDS—WEEDS.

On the duration of the vitality of the seed of various grains, A. BURGERSTEIN (*Verhandl. zool. bot. Ges. Wien, 45 (1895), No. 10, pp. 414–421*).—An account is given of an examination of the duration of vitality in seed of wheat, rye, barley, and oats, testing them when from 1 to 10 years old. The samples were taken from the harvests of 1885 to 1894, and were tested in June, 1892–'95. Part of the specimens were taken from sheaves of grain, the others as they came from the threshing machine. All were placed in paper pockets and kept in drawers in the laboratory. The germinations were between moist filter papers, 7 days being devoted to the test. The seed to be tested were taken without much inspection, only the injured and very small ones being rejected. From 100 to 200 seed of each lot were tested in a temperature varying from 19 to 26° C. The percentages given below are averages of from 1 to 3 tests of each lot:

Percentage of seed germinating at different ages.

Kind of seed	1 year.	2 years.	3 years.	4 years.	5 years.	6 years.	7 years.	8 years.	9 years.	10 years.
Winter wheat	100	98	95	94	87	87	85	79	70	75
Rye	96	83	90	78	65	64	36	31	13	2
Summer barley	100	99	99	96	97	97	95	94	96	95
Oats	98	87	98	95	94	93	94	94	92	93

From the above table it will be seen that barley retains its vitality best, followed closely by oats, while rye depreciates to such an extent as to be practically worthless for seed when 10 years old.

Tables are given showing the vitality of seed of different ages from

the same harvest and of the vitality of seed of the same age from different harvests. Seed of the same age but from different harvests show wide variations in their germinative ability.

The author claims that the duration of vitality in seed is dependent upon the following factors: (1) Variety or kind of seed, (2) degree of maturity at harvest, (3) the water content of the seed at the time of storage as well as at the time of testing, (4) method of handling the seed, and (5) the temperature at which the germination takes place.

On the quality of some seeds sold in the markets of England, W. CARRUTHERS (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 24, pp. 736-748*).—The author gives in tabulated form the results of tests made upon 243 lots of forage plant seeds purchased in the open market in various towns of the country. In general the tests showed high value, but in some cases the purity and germinative ability were very low. Tables are given showing the cost price of seed and the value of such when calculated from the intrinsic value of the sample. As an extreme case one lot of permanent pasture mixture seed selling at 16 cts. per pound would actually cost when the intrinsic value is considered about 53 cts. per pound of pure seed, or the cost of the quantity required to seed an acre, when based on its real value, would be about $17.15.

Contributions from the botanical laboratory of the seed-control station of Hamburg, V, O. BURCHARD (*Hamburg: W. Mauke Söhne, 1896, pp. 15, fig. 1*).—The present contribution contains a statement relative to slight changes in the tariff for examination of seed and in the quantity required for the average sample. The method for purity examination, especially of grass seed, is described at some length. The usual report is given of the station's examination of seed for the previous year. There were 529 samples of seed examined, requiring 845 separate tests, a considerable increase over the previous year's report. Examinations were made for dodder and the origin of clover seed. There is also a report of examinations made of several samples of flour and of concentrated feeding stuffs.

A brief description is given of the agricultural botanical experiment field of the station.

Squirrel-tail grass, or wild barley, L. H. PAMMEL (*Iowa Sta. Bul. 30, pp. 302-319, pls. 3, figs 3*).—Illustrated notes are given of *Hordeum jubatum*, and its distribution throughout the State is mentioned. Its presence appears to have been known for more than a third of a century, and now it is reported from more than half the counties of the State. Notes are given on the germination and dissemination of the seed. On account of its barbed awns and extended range this plant is considered one of the most pernicious weeds in the State. Numerous authors are cited as to the injury done to stock by the barbed awns, and especial effort should be made to keep the plant from maturing. If cut while young it will make good hay, but when the awns have had time to mature it should not be fed. The author thinks

there is an additional source of danger in the possibility of its spreading fungus diseases common to this and other species of grass. When its injurious qualities are considered, its value as a forage plant is so outweighed as to make it of little value.

Chemical composition of squirrel-tail grass, J. B. WEEMS and W. H. HEILEMAN (*Iowa Sta. Bul. 30, pp. 320, 321*).—The authors give analyses of samples of *Hordeum jubatum*, cut at 3 different stages of maturity. Based upon the dry matter the following results were obtained:

Analysis of dry matter of squirrel-tail grass.

Plant	Fat	Crude protein	Crude fiber	Nitrogen free extract	Ash.
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent.*
Young	5 45	24 91	23 07	33 46	13.11
Medium	4 14	15 07	28 61	39 50	12 68
Mature	3 52	9 04	34 08	42.06	11.30

Legislation against weeds, L. H. DEWEY (*U. S. Dept. Agr., Division of Botany Bul. 17, pp. 60*).—The author discusses the desirability of legislation for the eradication of weeds, and gives a table of weeds that are now proscribed by enactment in some of the various States having such laws. The essential provisions of a general State weed law are pointed out and a tentative form of law suggested. There are weed laws now in force in 25 States and Territories, and the text of the laws is given. The following States and Territories have statutes relative to weed repression: Arizona, California, Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, South Dakota, Vermont, Washington, West Virginia, and Wisconsin.

A new germination apparatus (*Oesterr. Forst. und Jadg. Ztg., 14 (1896), No. 11, p. 83, fig. 1*).—This device of J Stainer is claimed to be superior to others in that each seed is kept in a separate compartment, and a diseased seed, it is said, can not communicate the disease to others so readily.

Report of the Holland's Seed-Control Station, 1876-'93, A. LYTTKENS (*Holland's Läns. Kgl. Hushallning Handl., 1895, pp. 80*).—A report is given by the author of the work done at the seed-control station at Nydala, Sweden, from 1876 to 1893. A historical sketch is given of seed control, and the stations in Sweden making such tests are enumerated. Reports are given of the tests of numerous samples as well as cultural tests with various samples of seed.—T. HOLM.

A seed-germination apparatus, J. VAN DEN BERGHE and CASTELEIN (*Rap. Trav. Lab. Roulers, West Flanders, 1894, pp. 13-15, pls. 3*).—An apparatus especially designed for the testing of beet seed, and supplied with germinating beds of peat, sand, and other materials, and with a temperature regulator, is described and illustrated.

A poisonous weed, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, pp. 79, 80, pl. 1*).—Notes are given of the poison hemlock, *Conium maculatum*.

DISEASES OF PLANTS.

Field experiments with potatoes, B. D. HALSTED (*New Jersey Stas. Bul. 112, pp. 20, figs. 6*).

Synopsis.—A report is given upon field experiments conducted for the repression of the scab of Irish potatoes and the soil rot of sweet potatoes.

Experiments with Irish potatoes (pp. 3–12).—These experiments were conducted near Freehold, New Jersey, and at the college farm. At the first place an acre was selected, having all portions as nearly alike as possible, and laid off into 6 series of 5 plats each. Lime at the rate of 300 bu. per acre, flowers of sulphur 600 lbs., manure, corrosive sublimate 120 lbs., kainit 3,000 lbs., and sulphate of copper 300 lbs. were used upon the different plats in full, half, and quarter strengths.

Except on the manure plats, the plants did not make a good stand where the full amounts of the substances were used. Thus with corrosive sublimate and sulphate of copper there was only 10 per cent and with kainit 25 per cent of the normal growth. Where the half amounts were used the indications showed that the substances were still applied in too great strength, while with the quarter strengths the stand was practically normal except where the sulphate of copper was used.

In the lime series the average of the scab exceeded that of the checks as 60 to 47. Where sulphur was used the amount of scab was only 3 per cent. The plats receiving manure averaged 66 per cent of scab. Corrosive sublimate, kainit, and sulphate of copper held the percentage of scab down to a low degree. The 3 minerals used had the power of diminishing the scab in the following order: Sulphur, corrosive sublimate, and sulphate of copper. The relative practical value of these different substances must depend on the yield from the various plats where used, and it is shown that the full strength failed to give a yield equal to that of the check plats, 135 bu. per acre. Where half the amounts were used there was an increased stand of plants, a larger yield, and less scab. The largest yield was secured from the plats receiving the manure, but 50 per cent of the product was scabby. The next largest yield was secured from the plat receiving sulphur, where only 1 per cent of the product showed the presence of scab. Kainit gave a medium yield of excellent quality, lime following next with a considerable amount of scab. In the plats receiving quarter amounts of the substances 90 per cent of the potatoes produced on the lime plats were badly scabbed, followed closely by the plat receiving manure. The best plat, therefore, considering yield and freedom from scab, was one to which the sulphur was added, followed closely by corrosive sublimate and kainit, respectively. In the plats where the seed

was treated before planting corrosive sublimate gave better results than sulphur and kainit, but the yield was somewhat less. Sulphate of copper was also effective in keeping down scab, but the yield was only about half that of the best plats. From the seed-treated experiments it appears that kainit, corrosive sublimate, and sulphur are good for preventing scab. Taking all of the experiments, combining the soil with seed treatment, the best results were obtained with sulphur, followed by kainit and corrosive sublimate, respectively.

The experiments on the college farm were conducted upon cabbage ground which had the previous year received large quantities of lime, gas lime, kainit, and wood ashes, the object being to see if these substances would have any effect upon the crops and the scabbiness of the same. A portion of each plat received either corrosive sublimate, Bordeaux mixture, ammoniacal copper carbonate, or flowers of sulphur.

From the standard of yield there was no evident advantage derived from the fertilizers applied the previous year or of the amounts used. The seed potatoes used were all somewhat scabbed.

The results show that with the exception of 6 belts no potatoes were free from scab. In plat 1 where lime was used there was no difference in the amount of scab present if compared with the intervening plat where seed had been soaked in double strength corrosive sublimate. The best results obtained in this plat were from the portion which received a soil treatment of corrosive sublimate. In plat 2 100 per cent of scab was found except where Bordeaux mixture was applied, and there nearly a third of the potatoes were clean. The same was true in plat 3, except where ammoniacal copper carbonate was applied, where 20 per cent of the potatoes were free from scab. In plat 4 the results obtained from the others were repeated, except where sulphur was used. Here the potatoes were nearly free from scab and attractive in every way. Less than 5 per cent of the potatoes were scabby, and all were marketable.

This experiment upon the college grounds confirmed in a very emphatic manner the results obtained at Freehold, so far as the use of sulphur is concerned.

Experiments with sweet potatoes (pp. 13–20).—A piece of land was placed at the service of the station that was badly infested with soil rot of sweet potatoes, and upon which the crop of 1894 had completely failed. There were 6 series of plats in this field, 3 of them receiving fertilizers, namely lime, manure, and kainit. The 3 others alternating with these received sulphur, corrosive sublimate, and sulphate of copper. At harvesting the potatoes of each plat were inspected and assorted into those marked with soil rot and those showing no traces of it.

The average yield in pounds of clean and marked potatoes from the different plats is as follows:

Effect of fertilizers and chemicals on soil rot.

	Clean.	Marked.
Lime	24	21
Sulphur	56	22
Manure	4	25
Corrosive sublimate	49	32
Kainit	8	26
Sulphate of copper	18	40
Check	9	29

From these averages it will be seen that 2 of the 6 series, namely, manure and kainit, gave poorer results than the check plat. Of the 4 which gave favorable results sulphur gave the highest yield of clean roots, followed closely by corrosive sublimate. The potatoes from the sulphur plats were smooth and fair, free from scurf, cracks, and disfigurements, while the opposite was true of those from the corrosive sublimate plats. In addition the cost of the sulphur is practically half that of the corrosive sublimate. The limed plats yielded large round roots. The manure gave inferior roots, while the check plats gave among the largest roots, but they were very rough and much affected with soil rot.

Calculating the cost of application, where the least sulphur is used the cost of the treatment would be \$18.75 per acre, leaving \$20 clear profit. The results of a single season, and that an unusually dry one, indicate that sulphur and corrosive sublimate are both efficient in preventing soil rot.

The author's conclusions are as follows:

"Manure increases the scab and soil rot. Lime increases the scab, but diminishes the soil rot and tends to make sweet potatoes round. Kainit diminishes the scab but increases the soil rot. Sulphate of copper diminishes both scab and soil rot. Corrosive sublimate diminishes greatly the scab and soil rot. Sulphur is, all things considered, the best remedy for the scab and soil rot that the experiments suggest.

"For the Irish potatoes it is suggested that the flowers of sulphur, costing 2 or 3 cts. a pound, be used with the freshly cut seed in the hopper of the planting machine.

"For sweet potatoes the sulphur might be mixed with 5 times its bulk of fine earth, and a spoonful of the mixture placed in the hill just before setting out the plant."

Upon the effect of barnyard manure and various compounds of sodium, calcium, and nitrogen upon the development of the potato scab, H. J. WHEELER and G. M. TUCKER (*Rhode Island Sta. Bul. 33, pp. 51–79, figs. 6*).—The authors review the work of various stations relative to the cause and treatment of potato scab. The experiments here reported are in continuation of those reported in Bulletins 26 and 30 of the station (E. S. R., 5, p. 590; 6, p. 906). The comparative effects of ammonium sulphate and sodium nitrate show that on a limed

soil which already contains the fungus or which is especially adapted to its development nitrogen applied in the form of ammonium sulphate produced a crop containing less scab than when sodium nitrate was employed. In this respect the field tests confirmed the results obtained in 1894.

Pot experiments were undertaken to ascertain the effect of sodium chlorid, sodium carbonate, and oxalic acid upon the development of scab upon potatoes grown with the aid of barnyard manure. Oxalic acid was selected for the purpose of ascertaining if the acidity thus produced would have a tendency to reduce the percentage of scab. The results of the experiments show that where sodium chlorid was used there was less scab than where barnyard manure was used alone. Where the sodium was supplied in the form of the carbonate every tuber was more or less scabbed. Where the oxalic acid was employed there was less scab than where barnyard manure was used alone, and where it was used in connection with salt the total percentage of scab was less than in any other case.

Investigations upon the amount of scab produced in case of successive crops of potatoes upon soil favorable and unfavorable to the development of the disease showed that tubers treated with corrosive sublimate and untreated showed a greater amount of scab upon the limed plats than upon the unlimed ones, the difference amounting in some cases to 100 per cent. The results on the limed plat, where a moderate amount of contamination existed, showed that a decided advantage accrued from the treatment of the tubers with corrosive sublimate, but where potatoes had been grown for the two preceding years and the soil was badly infected, notwithstanding the treatment, every tuber was so scabbed as to be unfit for market. Sugar beets grown between the potato rows in the limed soil were badly scabbed, indicating that the soil had been contaminated from the potato crop of the previous year. Upon unlimed plats under similar conditions beets were grown absolutely free from scab. This seems to indicate that the germs of the disease which had been introduced in each case by the tubers had been rendered incapable of injury by the lapse of time upon the unlimed plat.

The effect of different forms of lime upon the development of scab was investigated, with the following results: Pots were given a fertilizer composed of dried blood, sodium nitrate, muriate of potash, and dissolved boneblack, after which the soil, to which the lime had been previously added, was thoroughly mixed. The seed tubers used in 1895 were badly scabbed and received no treatment. Air-slacked lime, cal cium chlorid, calcium sulphate, calcium carbonate, calcium oxalate, calcium acetate, and wood ashes were tested.

The average percentage of scab is given in the following table:

Percentage of scabbed tubers grown in soil containing various forms of lime.

Forms of lime used.	Free.	Scabbed.	Badly scabbed.
	Per cent.	*Per cent.*	*Per cent.*
Air-slaked lime	1.6	98.4	85.5
No lime	76.5	23.5	5.9
Calcium chlorid	100.0	....	....
Calcium sulphate	60.0	40.0	12.7
Calcium carbonate	1.0	99.0	88.1
Calcium oxalate	2.8	97.2	91.5
Calcium acetate	3.7	96.3	96.3
Wood ashes		100.0	90.3

From the foregoing table it may be seen that the influence of the lime upon the development of scab depends upon the combination in which it exists in the soil. The prevailing opinion that wood ashes increase potato scab and land plaster does not affect it seems to be well founded. The land plaster is not as efficient in promoting nitrification or renovating acid soils as some of the other forms of lime.

Barnyard manure and an artificial fertilizer were tested to ascertain the effect of barnyard manure upon the development of the scab. It was found that 76.5 per cent of the tubers in the plat which received the artificial fertilizer were free from scab as compared with 11.9 per cent from the plat receiving the barnyard manure.

Summarizing the author's conclusions, it appears that air-slacked lime, wood ashes, calcium carbonate, calcium acetate, and calcium oxalate promote scab to a high degree. Calcium chlorid, while injuring the plants, prevented the scab. Land plaster was the only form of lime that neither injured the plants nor increased the development of scab. Upon the acid soils of the station that have been partly neutralized with air-slacked lime, ammonium sulphate produced less scab than sodium nitrate. Common salt reduced the percentage of scab, and the use of seaweed as a fertilizer will probably secure the same results. Sodium carbonate acts the same as calcium carbonate in promoting scab. Barnyard manure, owing to its alkalinity or to the production of carbonates from it, has probably in and of itself increased the scab. Oxalic acid tended to reduce the amount of scab. In soil favorable to the scab the fungus seems capable of multiplying independent of the continual presence of potatoes or other root crops; hence the danger of introducing the scab into such soils. The use of corrosive sublimate should be resorted to wherever potatoes are planted on such soils. By the use of the proper chemical fertilizers it is possible to produce potatoes free from scab. The claim that soil has no effect upon the disease is unfounded.

"By the use of ammonium sulphate, and probably muriate and sulphate of potash, kainit, and common salt in connection with dissolved phosphate rock, dissolved bone, or dissolved boneblack, soils which now tend to produce scabby tubers would probably become less favorable to the disease. It is possible that a rational system of rotation of crops which would include no beets or other root crops, and perhaps no cabbages, would also help to alleviate the condition on such soils."

Infection experiments with club root of turnips (finger and toe disease), W. SOMERVILLE (*Jour. Roy. Agl. Soc. England, ser. 3, 6 (1895), No. 21, pp. 719–759, figs. 7*).—This report is in continuation of a previous one upon the effect of lime for the prevention of the club root of cruciferous plants (E. S. R., 6, p. 736).

Experiments were conducted to ascertain the result of infecting the crop at various periods of growth. Infections of the soil were made the previous autumn, at the time of thinning, and 1 month later. In every case the turnips were infected. When compared with the check plat, the plats receiving the infection material in autumn or at the time of thinning were most affected, the total yield of roots being considerably less than on the check plat. On the other hand, when infected 1 month after thinning, while the roots were affected, yet the weight of the roots was as 50 to 36 lbs. against the check, the presence of the fungus apparently having stimulated a more vigorous growth. Numerous swellings of the fungus growth were observed high up on the roots ot the late inoculated plants, from which the author concludes that the entrance of the parasite is not only through the root hairs but it is able to penetrate through the thick cuticle.

The popular belief that winter working of the soil would destroy the fungus was investigated, and such treatment seemed to stimulate rather than check the disease.

Experiments were conducted with lime, gas lime, sulphuric acid, sulphate of iron, sulphate of potash, sulphate of copper, bleaching powder, caustic soda, and caustic potash for the repression of the disease. The most favorable results as expressed in weight of crop followed the use of lime and copper sulphate upon the plats, followed by bleaching powder. Sulphuric acid, sulphate of iron, sulphate of potash, caustic soda, and caustic potash had absolutely no influence in checking the disease. On account of the failure of caustic soda and potash the author thinks the effect of the lime is due to some other factor than its alkalinity. In this he seems warranted, as copper sulphate proved next in value for repressing the disease. The author thinks from present indications promising results are to be expected from preventive treatment of diseased fields and crops.

Experiments on the treatment of peach rot and apple scab, F. D. CHESTER (*Delaware Sta. Bul. 29, pp. 21, fig. 1, dgms. 5*).

Synopsis.—A report is given upon the use of Bordeaux mixture and copper acetate solution for the treatment of peach blight and rot, and of Bordeaux mixture, to which London purple was added, for the prevention of apple scab.

In continuation of experiments begun in 1893, for the control of peach rot on early peaches, a third series of experiments was conducted during the season of 1895, the object of which was to test (1) the value of Bordeaux mixture and copper acetate, (2) different strengths of these solutions, and (3) to test the value of from 2 to 6 applications of the fungicides. The plan of the experiment was to apply the fungicides (1) when the fruit buds begin to swell, (2) just before they open, (3) after the

petals had fallen, (4) when the fruit was about the size of peas, (5) when the fruit had begun to color, and (6) about 2 weeks later. The fungicides were used in 3 different strengths, and with the exception of the first and second sprayings, every barrel of Bordeaux mixture received 3 oz. of Paris green.

As a result of the sixth application of Bordeaux mixture the fruit was stained, but all traces were removed by dipping the fruit into a weak vinegar solution. The copper acetate solution did not stain the fruit. After every spraying many leaves dropped, and by the time of the sixth application the difference between the amount of foliage upon the sprayed and unsprayed trees was very evident; however, the leaves remaining upon the sprayed trees hung on for more than 3 weeks later in the fall, thus securing a greater maturity of the wood. The results of the experiments show that 6 applications of Bordeaux mixture (copper sulphate 6 lbs., lime 6 lbs., and water 45 gal.) or of the copper acetate solution (copper acetate solution 8 oz., water 45 gal.) reduced the amount of rot to about one-third of that on the unsprayed trees. Four applications gave nearly as good results. There was about twice as much rot for 2 sprayings as with 4 or 6. Half-strength copper acetate solution was too weak to be effective. The cost of treatment need not exceed 2 cts. per tree, or 12 cts. per tree for the season's applications.

Comparisons are made of the results of this year's experiments with those of previous seasons, in which it is shown that 4, 5, or 6 sprayings to be most efficient should have 2 of them applied before the flower buds open. Where but 2 were given, the best results followed the application of 1 before blooming and the other when the fruit was about half sized.

General directions are given for spraying peach trees, including winter and early spring treatment.

The experiments for the prevention of apple scab were conducted to test the value of 1, 4, and 5 applications of Bordeaux mixture to which 4 oz. London purple per barrel was added for every spraying except the first. The formula for the Bordeaux mixture used was copper sulphate 6 lbs., lime 9 lbs, water 45 gal. The varieties of trees sprayed were Early Harvest, Strawberry, and Winesap. The results as tabulated show that from the Strawberry trees, a very susceptible variety, sprayed 5 times, the production of first-grade fruit was more than double that from trees sprayed but once, and the second-grade fruit was less than half that from the trees sprayed but once. In the other varieties the differences were less pronounced. The effect of spraying upon size and weight of fruit is graphically shown.

General directions are given for the treatment of apple trees for the prevention of scab at a cost of about 10 cts. per tree for the season. The addition of arsenites to the fungicide is recommended as a preventive agent against attacks of codling moth and other insects.

Treatment of currants and cherries to prevent spot diseases, L. H. PAMMEL and G. W. CARVER (*Iowa Sta. Bul. 30, pp. 289–301, pls. 7*).—The authors treated currants with Bordeaux mixture and ammoniacal copper carbonate for the repression of *Cercospora angulata* and *Septoria ribis*. Five applications were given, and the authors state that this number of applications of Bordeaux mixture in an ordinary season is sufficient to prevent the leaf spot of both red and white currants. The ammoniacal copper carbonate was not so efficient and is not recommended.

Several authors are quoted as to the efficiency of fungicides in preventing the leaf spot (*Cylindrosporium padi*) of cherries in the nursery. The authors experimented with Bordeaux mixture and ammoniacal copper carbonate for the repression of this disease, 5 applications having been given the young trees. At the time of the last spraying decided differences were apparent between the sprayed and check trees. Bordeaux mixture is considered a specific for the prevention of this disease. Ammoniacal copper carbonate is less efficient and injures the foliage to a considerable extent.

Plant diseases in their relation to biological sciences, J. RITZEMA-BOS (*Tijdschr. Plantenziekt., 1 (1895), No. 6, pp. 121–152*).

Concerning the work of the French phyto-pathological commission, F. NOACK (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 21–29*).—A review of recent publications on plant diseases due to fungi, insect injuries, and other diseases is given.

A contribution to the study of Œdomyces leproideus, P. A. SACCARDO and O. MATTIROLO (*Separate from Malphigia, 1895, pp. 10, pl. 1*).—A study of this beet disease is given.

Notes on cultures of Exobasidia, H. M. RICHARDS (*Bot. Gaz., 21 (1896), No. 3, pp. 101–108, pl. 1*).—From cultures of *Exobasidium vaccinii* and *E. andromedæ* the author thinks the species are probably identical. Further investigations are to follow.

A contribution to the knowledge of Coleosporium spp. and the pale rust of pines, G. WAGNER (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 9–13*).—Notes are given of *Peridermium pini* on *Pinus sylvestris* and *P. montana*, *Coleosporium senecionis*, *C. tussilaginis*, *C. petasites*, *C. euphrasiæ*, *C. melampyri*, *C. campanulæ*, *C. sonchi*, *C. cacaliæ*, and *C. subalpinum*.

Root diseases in New Zealand caused by Rosellinia radiciperda, G. MASSEE (*Bul. Roy. Gardens, 1896, pp. 7, pl. 1*).

Introduction to the study of parasitic plants, G. STAES (*Tijdschr. Plantenziekt., 1 (1895), Nos. 1, pp. 23–31; 2, pp. 57–60; 3, pp. 76–84, figs. 14*).

Smut in barley, W. CARRUTHERS (*Jour. Roy. Agl. Soc. England, ser. 3, 7 (1896), No. 25, pp. 143–146, fig. 1*).—Describes the cause of the disease and recommends the hot-water treatment for its prevention.

On the spotting of the seed of Brassica spp., J. RITZEMA-BOS (*Tijdschr. Plantenziekt., 1 (1895), No. 2, pp. 33–55, figs. 5*).

The smut of grains and their prevention, G. STAES (*Tijdschr. Plantenziekt., 1 (1895), Nos. 4, pp. 90–99; 5, pp. 101–112, figs. 7*).

Investigations on some of the important agricultural smuts, P. HERZBERG (*Inaug. Diss. Halle, 1895, pp. 33*).

The rusts of grain, G. LOPRIORI (*Landw. Jahrb., 28, pp. 969–1006; abs. in Bot. Centbl., 65 (1896), No. 6–7, pp. 229–231*).

Concerning rust fungi with reference to their æcidial stages, P. DIETEL (*Flora, 8 (1895), No. 2, pp. 394–404; abs. in Bot. Centbl., 65 (1896), No. 5, pp. 143, 144*).

Concerning the dry and wet rot of potatoes, A. PIZZIGONI (*Nuovo giorn. bot. Ital., 1896, p. 50; abs. in Hedwigia, 35 (1896), No. 1, Repert., p. 24*).—The author says that the dry rot of potatoes is due to *Fusisporium solani* alone, while the wet rot is due to the same fungus acting with various microörganisms.

On the appearance of the "American early blight" of potatoes in Germany, P. SORAUER (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 1–9, pl. 1*).

Concerning potato scab, G. STAES (*Tijdschr. Plantenziekt., 1 (1895), No. 1, pp. 19–23, pl. 1*).

Concerning the development of the rice and millet smuts, O. BREFELD (*Bot. Centbl., 65 (1896), No. 4, pp. 97–108*).—The author shows that instead of being related to Tilletia these are capable of forming sclerotia and are related to the ergots.

The sour rot of cane, F. A. F. C. WENT (*Med. Proef. Sta. West Java, No. 23, pp. 1–6, pl. 1*).—A disease that attacks the leaf sheath of sugar cane is described.

On the appearance of the West Indian rind fungus in Java, F. A. F. C. WENT (*Med. Proef. Sta. West Java, No. 23, pp. 6–12*).—The author discusses the possible identity of specimens of Melanconium with the *M. sacchari* of the West Indies.

Club root of turnips (*Gard. Chron., ser. 3, 19 (1896), No. 481, p. 332*).

The shot-hole fungus of the apricot (Septoria cerasina) (*Agl. Jour. Cape Colony, 9 (1896), No. 6, p. 135*).—Popular description, with remedies.

Concerning oïdium of the grape, J. DUFOUR (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, p. 57*).—The author considers flowers of sulphur as the best of the fungicides offered as preventives of the powdery mildew of the grape.

Diseases of the vine in Talca and Quirihue, Chile (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, pp. 96–99*).—Translated from *Bol. Soc. Nat. Agric. Chile.*

The larch disease (*Gard. Chron., ser. 3, 19 (1896), No. 482, pp. 367, 368*).—Popular notes are given upon the spread of this disease and of the apparent immunity of certain species to its attacks.

Abnormal carnation flowers (*Amer. Gard., 17 (1896), No. 63, pp. 145, 146, figs. 2*).—Notes on carnation flowers in which the petals are adherent, due, it is thought, to overmanuring.

Spraying to prevent apple and pear scab, S. H. DUBY (*Rural New Yorker, 55 (1896), No. 2411, p. 256*).

For the prevention of black rot in 1896, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 14, pp. 365–367*).—Suggestions are given for preventive treatment of black rot of grapes.

On the preparation of fungicides, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 13, pp. 339–342, fig. 1*).—Directions are given for making various fungicides.

On the strength of copper solutions used as fungicides, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 13, p. 339*).—The author thinks 2 per cent solutions of Bordeaux mixtures sufficiently strong for most cases. Where this does not answer, 3 per cent solutions will suffice.

The sulphate of copper in vine diseases (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, pp. 100, 101*).—Translated from *Bul. Soc. Nat. Agric. Chile.*

For the prevention of grape mildew in 1896, G. FOËX (*Prog. Agr. et Vit., 25 (1896), No. 13, pp. 337, 338*).—Suggestions are offered for the prevention of grape mildew by means of fungicides.

Mildiol as a protection against grape mildew, J. DUFOUR (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, p. 57*).—This substance is said to be inferior to Bordeaux mixture in combating the downy mildew of the grape. It was found efficient in destroying leaf lice on plants, both indoors and out.

Fowler's solution for carnation rust, E. G. HILL (*Amer. Florist, 11 (1896), No. 408, pp. 942, 943*).—Reiterates the successful results that have followed his employment of this method of combating the rust.

Fowler's solution for carnation rust, F. C. STEWART (*Amer. Florist, 11 (1896), No. 408, p. 942*).—The writer thinks the use of this solution of little value in preventing the disease.

Ceres powder, STEGLICH (*Sächs. landw. Ztschr., 1896, No. 8, pp. 75–78*).

On the value of ceres powder (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, p. 51*).—This powder, which is said to be the same as liver of sulphur, is considered as very efficient for the prevention of smut in oats and barley.

ENTOMOLOGY.

The Mediterranean flour moth, W. G. JOHNSON (*Appen. to Nineteenth Rpt. of State Entomologist of Illinois, pp. 65, figs. 7*).—This comprises an elaborate study of *Ephestia kuehniella*, and contains illustrated descriptive notes on the life history, habits, and ravages, with an account of experiments and practical efforts made to prevent damages by it.

The species was first noticed in Germany in 1877 and described in 1879, since which time it has spread over almost the whole world, appearing in Canada in 1889, California in 1892, and the eastern United States in 1895. The relationships of the insect are discussed, and it is believed to be a distinct species. Its ravages appear to be confined to mills, warehouses, or other places where wheat or flour is present. It breeds in large numbers, having from 4 to 6 broods annually. The silk spun by the larvæ webs together flour and dust in masses of varying sizes, which in mills rapidly accumulate and clog the machinery. Rice and buckwheat products are preferred by the larvæ, but all cereals are attacked. Extensive observations on the life history and ravages of the insect were carried on in California, where the flour moth is a most destructive pest, and are noted at length. In badly infested mills the moths are present to the extent of many thousands in all parts of the building, and the larvæ are found throughout the machinery and in every crack and angle where flour collects, and especially in the spouts. The larvæ and pupæ are attacked to some extent by the flour weevils (*Tribolium ferrugineum* and *T. confusum*), and by the hymenopterous parasite *Bracon hebetor*. A number of mills have been practically rid of the pest by fumigating with sulphur and bisulphid of carbon or by the application of steam. Directions are given for the use of these remedies. In the case of sulphur all flour and grain should be removed, as the fumes seriously depreciate the value of both the grain and flour. It is believed that by the combined use of steam and sulphur, and also by spraying with bisulphid of carbon, the pest can be kept well in hand, but thoroughness and repeated efforts will be necessary. The use of exceeding precautions to prevent the spread of the flour moth is most strongly urged.

An extended bibliography of the insect is appended.

The San José scale and other destructive scale insects, J. A. LINTNER (*Bul. New York State Museum, 3 (1895), No. 13, pp. 267–305,*

pls. 7).—This bulletin gives general information in regard to scale insects and particular remarks on some of the more destructive scale insects of the State of New York. Illustrated descriptive and life history notes are given on the apple tree bark louse (*Mytilaspis pomorum*), scurfy bark louse (*Chionaspis furfurus*), pine leaf scale (*C. pinifolii*), white scale (*Aspidiotus nerii*), maple tree scale (*Pulvinaria innumerabilis*), plum tree scale (*Lecanium juglandis?*), and San José scale (*Aspidiotus perniciosus*).

The life history, distribution, and ravages of the San Jose scale are given at some extent, chiefly compiled from publications of this Department and various agricultural experiment stations.

Several nurseries on Long Island were found to be infested by the pest, and steps were taken to induce the owners to rid their trees from the scale. It is believed that nearly all of the infested trees can be traced back to the two New Jersey nurseries where the insect was first introduced from California.

A list of 28 food plants in 10 natural botanical orders is given, 14 of the species attacked belonging to the order Rosaceæ. Suggestions are made for the adoption of legislation in the State against the San José scale.

The value of different insecticides is discussed and formulas given for the preparation of whale oil soapsuds, resin wash, potash wash, and hydrocyanic acid gas. Whale oil soapsuds is preferred as a winter wash and kerosene emulsion for summer.

A bibliography of the species is given.

Fourth report on the work of extermination of the gypsy moth, E. H. FORBUSH and C. H. FERNALD (*Massachusetts State Bd. Agr., Special Rpt. 1895, pp. 88, pls. 5*).—This deals with work in 1894 and contains the reports of the committee of the State board in charge of gypsy moth work, of the director of field work, and of the entomologist; a financial statement; and reports of 3 expert entomologists upon the pest. The methods of inspecting the trees and destroying the eggs, caterpillars, pupæ, and moths are described in more or less detail, and a list is given of 29 birds that have been seen to feed upon different forms of the pest.

The moth has been apparently exterminated from 10 places formerly infested, but still remains in 22 cities and towns. A vigorous prosecution of the work of extermination is urged, and more extended appropriations for this purpose are stated to be necessary. In 1894 nearly 7,000,000 trees were inspected, of which about 49,000 were found to be infested by some form of the insect. It is stated that over 1,000,000 caterpillars, 90,000 pupæ, 18,000 moths, and 18,000 hatched and 94,000 unhatched egg clusters were destroyed by hand during the year. Over 600,000 trees were surrounded with burlap to prevent the ascent of the female moth.

The entomologist has been studying the insect enemies and parasites

of the gypsy moth and also has conducted a long series of experiments with different insecticides.

The illustrations show different stages of the insect's life history and the defoliation accomplished by the pest.

A new contagious insect disease (*Ent. News*, *6* (*1895*), *No. 10*, *p. 324*).—A brief abstract of an article by S. A. Forbes.[1] The disease is a bacterial one, discovered in squash bugs (*Anasa tristis*). The microörganism is motile, larger than *Bacillus insectorum*, aërobic, and forms oval or fusiform colonies on agar, spreading as a radiate, thickish film. It multiplies freely in the blood of insects, killing the host in 2 or 3 days, probably by means of a toxin. Insects dipped into a watery infusion of an agar culture of this bacillus die in from 1 to 6 minutes. Chinch bugs are infected by exposure to dead insects. It is believed that this disease will prove of extreme value in fieldwork against chinch bugs.

The speculative method in entomology, R. MELDOLA (*Ent. Soc. London, Proc. 1895, Pt. 5, pp. LII–LXVIII*).

Remarkable work of insects, W. TRELEASE (*Canadian Ent.*, *28* (*1896*), *No. 3*, *p. 61*).—Notes on some silk tapestry made by the larvæ of *Ephestia kuehniella*.

Recent experiments on the dimorphism of butterflies, A. WEISMANN (*Naturwiss. Rundschau*, *11* (*1896*), *No. 14*, *pp. 173–174*).

An experiment bearing on the number of larval instars and the distinctness of larval and pupal instars in Lepidoptera, T. A. CHAPMAN (*Ent. Monthly Mag.*, *2d ser.*, *7* (*1896*), *No. 75*, *pp. 51–5?*).—By varied feeding efforts were made to retard or lengthen the larval stage of several species and change the normal number of months. By starving the larvæ of *Agrotis comes* and then freely feeding, a stage intermediate between the larval and pupal condition was produced

Literature on defensive or repugnatorial glands of insects, A. S. PACKARD (*New York Ent. Soc. Jour.*, *4* (*1896*), *No. 1*, *pp. ?–32*)

Ambrosia, E. F. SMITH (*Amer. Nat.*, *30* (*1896*), *No. 3??*, *pp. ?18, 319*).—Some notes on the fungus food of Xyleborus.

Insect friends and foes, C. FULLER (*Agl. Gaz. N. S. Wales*, (*1896*), *No. ?*, *pp. 88–95*, *figs. 12*).

Bee keeping, A. GALE (*Agl. Gaz. N. S. Wales*, *7* (*1896*), *No. 1*, *pp. 51–54*).

Castanea sativa as a honey plant, C. A. M. LINDMAN (*Bot. Centbl.*, *66* (*1896*), *No. 12*, *pp. 401–403*, *fig. 1*).

Flowers for honey, W. GRAHAME (*Amer. Gard.*, *17* (*1896*), *No. 6*, *p. 155*).—A short general article on the subject, lindens, clovers, vegetables, and fragrant flowers being recommended.

Parasites of poultry (insects and mites), F. V. THEOBALD (*Jour.* [*British*] *Bd. Agr.*, *1896*, *No. 4*, *pp. 420–426*).

The cheese skipper (*Cult. and Country Gent.*, *66* (*1896*), *No. 22?4*, *p. 293*).—Life history and remedial notes on *Piophila casei*.

On the appearance of Fidonia piniaria, KNAUTH (*Forstl. naturw. Ztschr.*, *5* (*1896*), *No. 2*, *pp. 46–58*).

Contributions to the life history of Spilothyrus alceæ (Hesperium malvarum), K. ECKSTEIN (*Ztschr. Pflanzenkrank.*, *6* (*1896*), *No. 1*, *pp. 17–19*, *fig. 1*).

Diplosis pyrivora, W. CRUMP (*Gard. Chron.*, *19* (*1896*), *No. 483*, *p. 400*).—Briefly discusses the life history of the pear midge, and suggests spraying the blossoming trees with soft soap, quassia chips, and Paris green in water.

[1] Science, n. ser., 2 (1895), No. 38, pp. 375, 376 (E. S. R., 7, p. 316).

On two new cecidomyids feeding on potatoes and on ivy, P. MARCHAL (*Bul. Soc. Ent. France, 1896, pp. 97-100*).—Notes on *Asphondylia trabuti* and *Dasyneura kiefferi*.

Ravages of Dermestes vulpinus in cork, W. J. HOLLAND (*Ent. News, 7 (1896), No. 3, p. 68*).—Brief notes on the presence of this beetle in an invoice of cork from Spain. Treatment with carbon bisulphid is recommended.

Heteronychus arator, S. D. BAIRSTOW (*Agl. Jour. Cape Colony, 9 (1896), No. 4, pp. 96, 97*).—Notes on this beetle attacking Indian corn.

Biological observations on Notoxus monocerus, E. TRAIZET (*Bul. Soc. Ent. France, 1896, p. 101*).—Several hundred individuals were attracted to dead specimens of Meloë.

Aspidistra scale in California, T. D. A. COCKERELL (*Garden and Forest, 9 (1896), No. 421, p. 118*).—Note on *Chionaspis aspidistræ* imported from Japan.

The pernicious, or San José, scale, W. M. MASKELL (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 868-870*)

A new coccid from Texas, T. D. A. COCKERELL (*Canadian Ent., 28 (1896), No. 3, p. 83*).—*Aulacaspis texensis* is described as a new species, found upon *Sophora secundiflora*.

Observations on Coccidæ, XIV, R. NEWSTEAD (*Ent. Monthly Mag., 2d ser., 7 (1896), No. 75, pp. 57-60*).—Notes on *Ripersia fraxini*, *Lecanium bituberculatum*, *Lecanopsis brevicornis*, *Icerya ægyptiaca*, and *Chionaspis aspidistra*.

The hibernations of aphides, C. M. WEED (*Psyche, 7 (1896), No. 239, pp. 351-362, fig. 1*).—A general article dealing with the life history of several American species. A number of forms spend the summer on trees and shrubs and the winter on herbaceous plants. The eggs of some species are stored over winter by ants in their galleries.

Cicada septendecim, its mouth parts and terminal armor, J. D. HYATT (*Amer. Monthly Micr. Jour., 17 (1896), No. 2, pp. 47-51*).

On a probable explanation of an unverified observation relative to the family Fulgoridæ, W. L. DISTANT (*Ent. Soc. London, Trans. 1895, pp. 429-432*).—Their luminosity is probably due to that of a parasitic organism.

Coleoptera found with ants, III, H. F. WICKHAM (*Psyche, 7 (1896), No. 240, pp. 370-372*).

On the longicorn coleoptera of the West India Islands, C. J. GAHAN (*Ent. Soc. London, Trans. 1895, pp. 79-140*).

Canadian hymenoptera, VII, W. H. HARRINGTON (*Canadian Ent., 28 (1896), No. 3, pp. 75-80*).—Notes on some species that were bred by the author.

On some hop pests, F. V. THEOBALD (*Ent. Monthly Mag., ser. 2, 7 (1896), No. 75, pp. 60-62*).—Brief notes on the earwig (*Forficula auricularia*) eating the leaves, and a hemipter (*Calocoris fulvomaculatus*) sucking the sap.

Insect friends and foes (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, pp. 90-97, figs. 11*).—The banded pumpkin beetle (*Aulocophora hilaris*), 28-spotted ladybird (*Epilachna 28-punctata*), and others.

Peach insects, J. B. SMITH (*Ent. News, 7 (1896), No. 4, pp. 107-111*).—Notes on *Sannina exitiosa*, *Aphis persicæ-niger*, and *Conotrachelus nenuphar*.

Insects injurious to pears, P. BROCCHI (*Jour. Agr. Prat., 60 (1896), I, No. 14, pp. 499-504, figs. 13*).

Some enemies of the grape, R. BRUNET (*Jour. Agr. Prat., 60 (1896), No. 10, pp. 356-362, pl. 1*).

A new enemy of the vine in Europe, P. LESNE (*Jour. Agr. Prat., 60 (1896), No. 10, p. 351*).—Brief note on the importation of *Margarodes vitium* into Europe.

Note on Margarodes vitium, V. MAYET (*Bul. Soc. Ent. France, 1896, pp. 30, 31*).—Remarks on its longevity and injury to grape vines.

Dangerous enemies of shade trees (*Garden and Forest, 9 (1896), No. 424, pp. 141, 142*).—In addition to the natural enemies of trees, such as insects, etc., attention is called to unnecessary injuries from various causes.

On the occurrence of caterpillars on conifers during 1895, R. HARTIG (*Forstl. naturw. Ztschr., 5 (1896), No. 2, pp. 59–64*).

Concerning the beech leaf gall mite (Cecidomyia fagi) J. RITZEMA-BOS (*Tijdschr. Plantenziekt., 1 (1895), No. 5, pp. 112–117, figs. 2*).

A gall of Corylus tubulosa, E. BARONI (*Soc. Bot. Ital. Bol. 1895, pp. 177, 178; abs. in Ztschr. Pflanzenkrank., 6 (1896), No. 1, p. 40*).—The galls are produced by *Phytoptus coryl-igallarum.*

Three hostile engagements with bugs, F. PALMER (*Rural Californian, 19 (1896), No. 1, pp. 13–15*).—An account of the method and cost of fumigating orange trees with hydrocyanic-acid gas.

Our household pests: an account of the insect pests found in dwelling houses, E. A. BUTLER (*London: Longmans, pp. 354*).

Injurious insects and plant diseases of Norway in 1894, W. M. SCHOYEN (*Abs. in Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 30–33*).

Various methods of combating plant lice and allied insects, E. FLEISCHER (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 13–17*).

Methods adopted in the Island of Elba to eradicate the phylloxera (*Bol. Soc. Nac. Agr.: Agl. Gaz. N. S. Wales, 7 (1896), No. 2, p. 102*).

On the use of raupenleim as a protection against the Russian cock chafer (*Centbl. ges. Forstw., 22 (1896), No. 3, pp. 112–115*).

Combating injurious insects by means of their parasites, I. KRASSILSHTSHIK (*Prog. Agr. et Vit., 25 (1896), No. 11, pp. 372–382*).—A critical review of the subject.

The hymenopterous parasite of the Angoumois moth, F. H. CHITTENDEN (*Ent. News, 7 (1896), No. 4, pp. 106, 107*).

FOODS—ANIMAL PRODUCTION.

Bacteria in British baked bread, J. LAWRENCE-HAMILTON (*pp. 2; reprinted with additions from The Lancet (London), 1894, December 8*).—Since the question whether bread is sterilized in the ordinary processes of baking is receiving considerable attention, a number of the more recent publications on the subject are cited by the author.

British bread is regarded as of inferior quality, and the need of technical education in bread baking is insisted upon.

Three experiments in bread baking are reported. Two maximum thermometers were inserted into the center of each of 3 loaves weighing 2 lbs., made of "pure dough and yeast." The bread was baked 1 hour and 35 minutes in a gas oven at about 350° F. The gas was then turned off. One thermometer was quickly withdrawn from loaf 1 and found to register 192°. The loaf was allowed to remain in the oven for 5½ hours to cool. The second thermometer was then found to register 210°, *i. e.*, during the "continuation and completion of cooking there was a rise of 18°." Loaf 2 was cooled under a specially constructed insulator, and a rise of 7° was observed in the center of the loaf during the completion and continuation of cooking during cooling. Loaf 3 was allowed to cool in the kitchen, and a rise of 14° was observed.

The corresponding rise in temperature in large joints of meat is said to often exceed 30°, provided the meat is allowed to cool without being cut.

These facts, according to the author, have not been pointed out before. In explanation it is suggested that "as the mass cools down a portion of the heat of the crust of bread or the outside of the joint becomes absorbed by the interior." The 2-pound loaves, by baking and drying, and cooling for 23 hours, lost 5 oz. in weight, or 15 per cent.

The flavor of bread, J. GOODFELLOW (*The Miller, 21 (1895), No. 877, pp. 678, 679.*)—The author in a popular article discusses some of the points which influence the flavor of bread. He considers the flavor to be due (1) to the "nature of the soluble constituents of the bread, and (2) to the presence of bodies which are volatilized in the mouth and pass to the nose." Among the points noted are the effect upon the flavor of bread of physical condition of flour, flour from different wheats and different grades from the same wheat, roller flours, and salt; the influence of fermentation produced by several sorts of yeasts; and the effect produced by the addition of malt extract, diastase extract, yeast, and yeast foods to bread. The effect of milk and fat on bread is also noted, and "nutty" flavor is spoken of at some length.

On the distribution of nitrogenous and mineral matter in bread, BALLAND (*Compt. Rend., 121 (1895), No. 22, pp. 786–788; Meunerie Française, 11 (1895), No. 121, pp. 279–281*).—A considerable number of samples of bread were analyzed, and no appreciable difference was found in the composition of the dry matter of the crust and crumb. The nitrogen and ash in each were practically the same. This is contrary to the opinion of some earlier investigators. The dry matter of the bread did not differ materially in composition from the dry matter of the flour from which it was made. If the constituents of the flour undergo modification in baking the bread, the change is so slight that it can not be detected.

Bread made with skim milk and its digestibility by man, H. RECLESTEINER and W. SPRING (*Schweiz. Molk. Ztg., No. 19, 1895; abs. in Milch Ztg., 21 (1895), No. 50, pp. 811, 815*).—Bread, the principal article of diet of large classes, is deficient in protein and fat. The authors recommend that it be improved in this respect by making it with skim milk instead of water. If the cost must remain the same a somewhat cheaper flour may be used. Experiments on the digestibility of skim-milk bread were made, and the results showed it to be very well assimilated.

A cooking thermometer, J. LAWRENCE-HAMILTON (*p. 1, pl. 1; reprinted from The Lancet (London), 1894, June 30*).—The author describes a thermometer particularly suited for experimental and practical cookery. The thermometer is mounted on a white porcelain stand with a square base. The scale, also of white porcelain, is graduated from about 200 to 550° F., and the proper temperature for frying in oil, butter, lard, or fat, and for roasting or baking pastry, fish, and various meats is indicated. Tests made with several thermometers showed that the heat varied considerably in different parts of the oven.

Further contribution to the question of the influence of a food with acid characteristics on the organism, and more especially upon the skeleton, II. WEISKE (*Ztschr. physiol. Chem., 22 (1895), pp. 595–605*).—It has been found that when herbivora, rabbits for instance, are fed entirely upon oats they eat the food readily and increase in weight for a time. Eventually, however, the animals die. The fact is explained as being due to the acid character of the ash of the food and the sulphuric and phosphoric acids produced from the protein of the food by oxidation. Carnivora possess the ability to regulate the formation of acid in the organism by the formation of ammonia, which neutralizes the acid. Herbivora lack this power. If calcium carbonate, magnesium carbonate, or similar salts are fed with the oats to an adult animal the animal thrives normally. With young animals calcium carbonate is the only salt which seems to answer the purpose. When oats alone are fed the total weight of the skeleton is less than normal. The percentage of organic matter in it is increased and that of mineral matter is diminished.

The value of calcium sulphate and calcium phosphate when fed with oats was investigated in experiments which were made with rabbits. Five animals were selected, two of these being killed at once and the skeletons analyzed. Two were fed for 46 days with oats and during this time consumed an average of 0.38 and 0.43 gm. of calcium sulphate per day, respectively. One rabbit was fed for the same time on oats and consumed an average of 0.40 gm. of calcium phosphate per day. The rabbits were killed and the skeletons analyzed.

In all cases the percentage of organic and inorganic material was about the same. The salts were found to have little if any value.

The influence of light on animal metabolism (*Milch Ztg., 24 (1895), No. 46, p. 747*).—The article is a somewhat extended commentary on and review of some recent experiments. The following points are brought out:

Metabolism in animals is influenced by light, as is shown by the fact that under the same conditions of nutrition man and animals produce more carbon dioxid in light than in darkness. This indicates increased metabolism. This fact has received practical recognition. When it is desired to fatten animals they are not usually kept where the light is bright.

Weiske and Graffenberger have recently investigated the problem in experiments with rabbits. The animals were given the same ration for some time. They were then killed, and in every case it was found that the animals kept in the dark were fatter than those kept in the light. This fact was more noticeable with old than with young rabbits. It was also found that if the animals remained a long time in the dark the accumulation of fat was not proportional to the length of the experiment. Unfavorable symptoms were noticed. The blood diminished in amount and also contained fewer red corpuscles. After a time

it would be impossible for the animal to maintain a normal existence. It is therefore advised that the animals be given an abundance of light when it is desired to have healthy normal animals, for instance, for breeding purposes and when an active metabolism is desirable as in the case of milch cows and draft animals.

On the other hand when it is desired to fatten animals for a short period before slaughtering it would be of great practical value to keep them in a stall which is more or less dark, and thus diminish the amount of metabolism and increase the flesh and fat produced from a definite amount of food. The general conclusion reached is that light increases and darkness diminishes metabolism.

Experiments on the digestibility and nutritive value of pumpkin-seed cake and buckwheat, A. WICKE and H. WEISKE (*Landw. Vers. Stat., 46 (1895) No. 1-5, pp. 371-382*).—In Poland, Hungary, and other localities an oil is expressed from pumpkin seeds and the oil cake which is left is used as a food for milch cows and also for fattening cattle. The cattle are very fond of it. Buckwheat is used as a concentrated feeding stuff for swine, cattle, and sheep. These two feeding stuffs were selected for experiment as being among the few which had been little investigated. The composition was found by analysis to be as follows:

Composition of pumpkin-seed cake and buckwheat.

	Pumpkin-seed cake.	Buckwheat.
	Per cent.	*Per cent.*
Protein	43.75	14.44
Ether extract	26.78	3.26
Crude fiber	5.59	10.28
Nitrogen-free extract	15.41	69.57
Ash	8.47	2.45

Three experiments were made with 2 full-grown sheep. In the first experiment, which lasted 16 days, each animal was fed a ration consisting of 1,000 gm. of meadow hay. In this and the succeeding experiments the feces were collected for 8 days. The average digestibility of the hay is given in the table below. The second experiment, which lasted 16 days, was made with 1 animal. The ration consisted of 900 gm. of meadow hay and 100 gm. of pumpkin-seed cake per day. In the third experiment 1 sheep was fed for 14 days and the other for 15 days a ration consisting of 800 gm. of hay and 200 gm. of unground buckwheat. Taking into account in each case the digestibility of the hay, the digestibility of the pumpkin-seed cake and of the buckwheat was calculated for the separate sheep, the results being given in the following table:

Digestibility of pumpkin-seed cake and buckwheat.

	Dry matter.	Organic matter.	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Meadow hay	63.78	65.84	56.12	61.42	65.30	66.40	40.67
Pumpkin-seed cake	83.15	88.55	84.73	104.68	118.76	42.74	56.10
Buckwheat:							
Sheep No. 1	74.22	74.55	79.73	92.37	40.21	77.56	62.04
Sheep No. 2	67.37	67.65	69.76	108.87	7.94	74.03	50.93

The coëfficients of digestibility in several cases are found to be greater than 100. This is explained as due to unavoidable errors of observation. The following conclusions were reached: Pumpkin-seed cake is one of the very digestible feeding stuffs. All the nutrients of buckwheat except the crude fiber are very digestible. Both foods are very valuable if not fed in too large quantities. The coëfficients of digestibility here given are believed to represent about the highest limit for these feeding stuffs.

The ventilation of cow stalls with warmed air, L. VON TIEDEMANN (*Die Lüftung der Viehställe mit erwärmter Luft. Berlin: Unger, 1895, pp. 11, figs. 10*).—In these experiments the author intended to use the motive power of the wind to produce the desired change of air, and to warm the ingoing current by taking some heat from the outgoing current. Illustrations are given to explain the 5 devices employed, of which the author prefers the two following: (1) A wooden flue, 40 cm. square inside, with a hood at the top and with 2 opposite lateral openings 40 cm. by 40 cm. at both top and bottom, was divided throughout its length by a diagonal partition of corrugated zinc. The upper openings were furnished with flaring or hopper-shaped approaches. (2) In a square wooden flue, 30 cm. inside, was placed a zinc pipe 22 cm. in diameter, extending from the bottom just through the hood of the flue. At the top were 4 lateral openings, 26.5 cm. by 20.5 cm., in the wooden flue to admit the ingoing currents, and one at the bottom on the opposite side from that on which the zinc pipe entered. The upper openings had flaring approaches and were fitted with thin wooden trapdoors, hinged vertically at one side, which would swing in against the zinc pipe to admit a current of air from without. These flues extended above the roof of the building and a short distance below the ceiling of the stable. In each device a current of air entering one of the upper openings would be conducted to the stable below and force out a corresponding amount of warm air through the other division of the flue, and, as the two currents were separated only by a thin metal partition, some of the heat of the outward current would be given off to the ingoing current. The first flue was in a stable 92½ by 37½ by 11⅔ ft., containing 48 cows; the second was in a stable 62¼ by 37½ by 11⅔ ft., containing 32 cows.

Five series of observations were made, covering the following points: The amount of incoming and outgoing air, the temperature of the outside air and of the air in the stalls at different heights, the increase of temperature of the incoming air, and the moisture content of the stable air.

The author found that on still days the warm air of the stable went out through all the divisions of the flues, its place being supplied by the cold air which came in about the doors and windows. Had all these spaces been closed the author thought the flues would have worked as intended. On windy days there was a rapid change of air, but in the

flues the incoming current was less than the outgoing current, due to the influx of cold air through the cracks in the building. There was a very significant warming up of the incoming cold current by the heat given off by the warm outgoing current through the thin metal partitions. This was the more marked the greater the difference between the outside and inside temperature. This rise in temperature of the cold air, which was a direct saving of heat, was from 5.2 to 14.4° C. during the observations. The cooling off of the outgoing air caused a deposition of the moisture in the ventilation flues. This passed into the gutter in the stable instead of injuriously wetting the walls and ceiling.

The fresh air was still further warmed by admitting it horizontally near the top of the stable, and thus allowing it to mix with the warm air at that height before it descended.

The author considers that, with a moderate wind, the first flue described is sufficient to supply at least 15 head of grown cattle with fresh air.

Crossing improved breeds of swine with the common hogs of Florida (*U. S. Dept. Agr., Bureau of Animal Industry Circular 1, pp. 3*).— In reply to inquiries on the subject, R. W. Furnas, secretary of the Nebraska Board of Agriculture, stated briefly his results in crossing Florida hogs with improved breeds. A pair of "razor backs" were procured from Florida and the boar was crossed with a Red Duroc sow. The sows obtained were crossed with a Poland China boar, and the sows obtained this time were crossed with a Yorkshire boar. The results of these experiments were considered very satisfactory. The mixed breed swine furnished excellent meat and were very healthy. They were apparently rugged enough to resist disease. The good qualities of the meat of Florida hogs were also found in the cross breeds.

"After the first cross these hogs fatten as readily and cheaply as any other breeds. Experts, from a market standpoint, would find them wanting in size of ham, not noticeable in second and third crossing. Size of animal in first cross might be objectionable, yet they run up to 200 and 250 lbs. quickly and cheaply. I marketed a first-cross barrow at 16 months old at 180 lbs on foot."

Feeding wheat to hogs, W. J. SPILLMAN (*Washington Sta. Bul. 16, pp. 12*).

Synopsis.—Tests were made on feeding wheat prepared in 5 different ways. The best results were obtained with cracked wheat dry and whole wheat soaked.

Thirteen grade Poland China and grade Berkshire pigs, averaging 197⅓ lbs. in weight, were divided into 3 lots of 3 each and 1 lot of 4. A comparison was made of whole wheat fed dry and soaked for 12 hours, cracked wheat fed dry and soaked for 12 hours, and sheaf wheat. The dry and soaked cracked wheat was fed to 3 lots, the other rations to 2 lots. The animals were always fed *ad libitum*. Each lot was placed in a pen containing about 4 square rods and having a shelter. The periods were of 15 days' duration. The wheat used in these experiments was badly affected with stinking smut, but although

some of the pigs were affected with a cough before the experiment this soon stopped and they remained in good health.

The average gain per head and the gain per bushel of wheat eaten are given in the following table:

Results of feeding pigs wheat prepared in various ways

Lot	Food	Average gain per head	Average gain per bushel of wheat
		Pounds	*Pounds*
1	Whole wheat dry	14.90	9.7
4	do	15.50	9.1
	Average	15.20	9.4
2	Whole wheat soaked	17.20	9.1
1	do	22.70	11.3
	Average	19.95	10.2
3	Cracked wheat dry	26.90	12.7
2	do	23.20	12.4
1	do	27.20	14.2
	Average	25.76	13.1
4	Cracked wheat soaked	21.80	11.9
3	do	23.10	11.8
2	do	20.30	10.3
	Average	21.73	11.3
4	Sheaf wheat	5.50	3.7
3	do	2.20	1.9
	Average	3.8	2.8

The following conclusions were reached

"(1) Feeding sheaf wheat to hogs is a wasteful practice even under the best conditions a large amount of grain is wasted and the hogs can not find enough grain to fatten on rapidly.

"(2) Soaking whole wheat in water for 12 hours increases its digestibility so that it will produce about 1 lb more pork per bushel eaten.

"(3) Wheat coarsely chopped and fed either dry or soaked 12 hours in water gives larger returns than whole wheat. Under the conditions of this experiment the increase was sufficient to more than pay for the chopping.

"(4) Dry chopped wheat gave a larger yield of pork than soaked chop but this may have been due to the order in which the feeds were given each lot.

"(5) With hogs weighing less than 250 lbs a bushel of chopped wheat will produce about 12 lbs of pork.

"(6) With wheat at 21 cts a bushel pork can be produced at a cost of 2¼ cts a pound. Wheat at 19½ cts a bushel produces pork at a cost of 2 cts a pound.

Pig-feeding experiments with wheat, Kafir corn, and cotton seed, C. C. GEORGESON, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 53, pp. 103-111*).

Synopsis.—The questions studied were (1) the relative value of wheat, corn, and red Kafir corn for fattening pigs; (2) the effect of cotton seed meal, and (3) comparison of corn meal and ground wheat with a mixture of both as a food for young pigs. The principal conclusions reached are (1) that red Kafir corn though valuable is not equal to wheat or corn, (2) cotton seed meal is poisonous if fed for any considerable length of time, and (3) a mixture of wheat and corn meal is better than either ingredient alone.

The experiments were divided into 3 series, and were made during winter; 133 Poland-China and Berkskire pigs were used, and they were confined in a piggery which was cold and dark.

Series 1.—The object in this series was to test the relative feeding value of red Kafir corn meal, corn meal, and ground wheat. Twelve pigs about 8 months old, and which had been on pasture the previous summer, with little grain, were divided into 3 equal lots, and each pig placed in a separate pen and fed separately. Lot 1 had red Kafir corn meal, lot 2 corn meal, and lot 3 ground wheat, *ad libitum.* The trial lasted from December 27 to March 14, 77 days. At the conclusion the pigs were in fine marketable condition.

In the following table the average results are given:

Comparison of Kafir corn, corn, and wheat, all ground, for pigs.

Lot	Grain	Average weight of animals at beginning	Average amount of grain eaten	Average daily gain	Grain eaten per pound of gain
		Pounds	*Pounds*	*Pounds*	*Pounds*
1	Red Kafir corn meal	153	545.1	1.37	5.15
2	Corn meal	152	573.5	1.70	4.38
3	Ground wheat	163	564.2	1.78	4.11

The conclusions drawn are that the red Kafir corn was the least effective food and wheat the most effective, corn being nearly as good as wheat. But in the experimenters' opinion red Kafir corn is a valuable grain well suited to fattening. They insist that the kernels be finely ground, otherwise a considerable portion is not digestible, since the grains are very hard.

Series 2.—The object in this series was to determine the effects of cotton seed meal as a food for young pigs, and also to compare corn meal and wheat with a mixture of both. In the first trial 4 small pigs were fed a ration consisting of ⅚ corn meal and ⅙ cotton-seed meal. It had been found that they would not eat a ration of ⅔ corn meal and ⅓ cotton seed meal. They did not appear to relish the food at first, but became reconciled to it after a time. Before the expiration of 6 weeks the pigs had all died. Though drowsy, they were all apparently in good health until a few days before death. One of the symptoms of the short illness was coughing. An examination showed that death was due in each case to congestion and inflammation of the intestines, lungs, and heart.

The second experiment in series 2 was a continuation of the first, and was made with 2 sows. The ration consisted of ¾ corn meal and ¼ cotton-seed meal. The sows continued to gain for 45 days on this diet and showed no symptoms of disease. The experiment was then discontinued. In the authors' opinion this experiment shows that cotton-seed meal can be used to advantage for short periods in feeding hogs for the market.

In experiments 3, 4, and 5 of series 2 the feed was corn meal, corn meal and ground wheat in equal parts, and ground wheat, respectively. There were 4 animals in experiments 3 and 4 and 3 animals in experiment 5. The time was 112 days.

None of the gains were considered very satisfactory; several pigs, indeed, did very poorly. The average daily gain on corn meal was 0.38 lb., on corn meal and ground wheat 0.45 lb., and on ground wheat 0.42 lb.

The conclusion reached is that a mixture of equal parts of corn meal and ground wheat proved a better feed than either wheat or corn alone, and wheat is considered better than corn. The poor gains made are attributed to the monotonous diet and confinement which were conditions incident to the experiment.

Series 3.—The object was to determine the effect of feeding cotton-seed meal. Two experiments were made, in each case with 3 animals selected from those used in series 2. The animals were all runts. In the first experiment the ration consisted of ¼ cotton seed meal and ¾ corn meal. In the second it consisted of equal parts of cotton-seed meal and corn meal. The other conditions were the same as in series 2. The animals began to improve immediately on this diet and made excellent gains. The good results, however, were not permanent, for on the 45th day 1 of the animals in experiment 2 died and on the 56th day there was only 1 pig remaining in each of the 2 lots. Examination showed that death was due to the same causes as in series 2. The experiments were therefore discontinued and the 2 pigs turned out to green feed. This change was made with a view to ascertaining whether the poison from cotton-seed feeding was cumulative and would remain after a change of feed. That it was not of this nature was shown by the fact that the animals recovered good health and never afterwards showed the slightest symptoms of disease.

In the first experiment the average daily gain was 0.44 lb., and in the second 0.75 lb.

The conclusion reached was that it is not safe to feed cotton-seed meal except for a short time. The bad effects are noticed even when it is fed in small quantities. For a short time the hogs made very rapid growth, and therefore the experimenters conclude that cotton-seed meal may be fed for a short time with the best results, provided the feed is changed before symptoms of ill health appear. A herd of steers had been fed during the winter with cotton-seed meal from the same lot which was used in this experiment. A lot of hogs ran with the steers and had all died in the course of 6 or 7 weeks. No attempt was made in any of these experiments to determine the nature of the poison from the cotton-seed meal.

Winter rations for horses; grain rations for work horses, J. H. SHEPPERD (*North Dakota Sta. Bul. 20, pp. 137–151*).—Experiments made with 8 horses and 4 mules on the comparative value of different rations.

The animals were divided into 4 uniform lots containing 2 horses and 1 mule each. All the animals were given good care and comfortable quarters. The amount of food eaten, gains made, and work done are tabulated for each lot and each animal.

Oat straw as rough feed.—For 30 days lots 1 and 3 were fed grain and prairie hay and lots 2 and 4 grain and oat straw, the rations being reversed for the following 30 days. The grain for lots 1 and 2 was oats and for lots 3 and 4 a mixture of equal weights of bran and shorts. All the animals performed a moderate amount of work.

The financial statements are based on oats at 25 cts. per bushel, and bran and shorts at $12, hay (prairie) $5, and straw $1 per ton.

The conclusion is reached that horses at light work can be maintained on straw, provided sufficient grain is fed. At the above prices the straw ration was the cheaper. "It requires more careful feeding to keep the horses in good condition on a straw ration, as the quantity of grain the different ones will require differs more than when hay is fed."

Oats vs. bran and shorts.—Four experiments were made. In the first experiment all 4 lots were used and the time was 90 days. The work done was quite severe. In the second experiment only 3 lots were used, and in the third and fourth experiments 2 lots were used. Each of the latter 3 experiments lasted 4 weeks, and the work done was moderate. For a time certain of the lots were fed a ration consisting of oats and hay, and the remaining lots bran, shorts, and hay. Then the rations of the lots were reversed. The work was the same for the lots compared.

Though the results varied somewhat in the individual experiments, on the whole little difference was shown in the feeding value of the 2 rations. The author's conclusion is that bran and shorts in equal proportion are practically equal to oats.

Wheat as a horse feed.—One lot was fed unground wheat for 4 weeks. The average amount consumed was 384 lbs., gain in weight 15 lbs., and work done 194 hours. The grain was poorly digested, and the author concludes that it is not desirable to feed wheat alone as a grain ration.

Wheat, bran, and shorts vs. bran and shorts.—Two lots were used in this experiment, which covered 4 periods of 4 weeks each. In the first and third period 1 lot was given a ration of equal parts by weight of bran, wheat, and shorts and the other a ration of equal parts of bran and shorts. In periods 2 and 4 the rations were reversed.

The conclusion is reached that no advantage is gained by adding wheat to a ration consisting of bran and shorts.

Oats vs. bran and ground wheat.—One lot was used in this experiment, which covered 4 periods of 4 weeks each. In periods 1 and 3 the ration consisted of oats and hay and in periods 2 and 4 of a mixture of 1 part by weight of bran and 2 parts of ground wheat, with hay.

The conclusion is reached that ground wheat and bran is a better ration for horses at light work than whole oats.

Food investigations and publications, W. O. ATWATER and C. D. WOODS (*Connecticut Storrs Sta. Bul. 15, pp. 16*).—The purpose of this article is to show what is meant by food investigation, to give briefly some of the results already obtained, and to point out lines which need further research. The work at present in progress with the respiration calorimeter, dietary studies, and other food investigations under the supervision of this Department are briefly described.

Japanese lilies as articles of food and commerce, J. NITOBE (*Garden and Forest, 10 (1896), No. 111, pp. 12, 13*).—The edible lilies are discussed in a popular article. A number of the more palatable varieties are mentioned and an analysis is given.

Analysis and comments on Quaker oats (*Ztschr. Nahr. Untersuch. und Hyg., 10 (1896), p. 115*).—An analysis of Quaker oats by A. Smita is reported.

On a sample of rice over a century old, BALLAND (*Compt. Rend., 122 (1896), No. 14, pp. 817, 818; abs. in Rev. Sci., ser. 4, 5 (1896), No. 16, p. 502*).—Several analyses of the old rice stored in Cochin China since 1785 and of new rice are reported, which show that the principal difference between the two is due to the disappearance of the fat in the old rice, the acidity remaining unchanged.

Flour from the sorghums, F. D. COBURN (*Cult. and Country Gent., 66 (1896), No. 2254, p. 297*).—In a note the author states that considerable flour is being ground from Kafir corn in Kansas. The flour is considered very desirable for rolls and cakes, but not so desirable for bread. Improvements in milling are awaited.

Bread, J. KJENNERUD (*Brodt. Christiania, Hafner and Hill, 1895; reviewed in Jour. Hyg., 21 (1896), p. 180*).—The book is said to be a very complete monograph on the subject. There are chapters on cereals and flour, baking of bread, and hygiene of baking.

Bread baked until dry, L. L. MOUHIN (*Ind. Agr., 40 (1896), No. 93, pp. 24, 25*).—A quick process of baking bread is described which makes the bread dry and in the author's opinion more palatable and digestible.

Determination of the baking quality of flour and of the admixtures of parts of seed coats and germs capable of injuring the quality, A. GIRARD (*Compt. Rend., 121 (1895), No. 24, pp. 858-862*).—The various parts of the bran were separated from the germ and examined with a microscope. Some of these products are harmless and others injure the flavor of the bread. A table is given showing the proportion of bran impurities in several sorts of flour.

On the value of sterilized milk as food (*Orgaan Ver. Oudleer. Ryks. Landbouwschool, 8 (1896), Nos. 90, pp. 2-4; 91, pp. 18-21*).—A summary of the subject quoting the work of a number of authors.

The value of meats as foods, R. H. CHITTENDEN (*Diet. and Hyg. Gaz., 12 (1896), Nos. 3, pp. 131-139; 4, pp. 199-201*).—In a lecture delivered at the Pratt Institute in Brooklyn the author reviewed the subject and shows why meat is a valuable and desirable food for man.

Horseflesh as food, J. ESSER (*Jour. Landw., 43 (1895), No. 4, pp. 349-358*).—The article includes an historical account of the use of horseflesh for food, statistics, and a discussion of its value.

Hospital diet, E. H. RICHARDS (*Amer. Kitchen Mag., 5 (1896), No. 1, pp. 21-23*).—The dietary best suited to hospital patients is discussed and suggestions are offered.

The food of the Japanese, M. H. ABEL (*Amer. Kitchen Mag., 5 (1896), No. 1, pp. 8-10*).—The dietary of the Japanese is discussed in a popular article. Some of the Japanese foods are described in detail.

Analyses of chicory and coffee, D. CRISPO (*Rap. Trav. Lab. État. Anvers 1894, pp. 19, 20*).—The food constituents of roasted chicory and food and fertilizing constituents of coffee are reported. In case of the latter the amounts of fertilizing matter removed by a crop are calculated.

The pure food question in Pennsylvania, L. WELLS (*Pennsylvania Dept. Agr. Bul. 3, pp. 37*).—The bulletin includes an article by H. Leffman on food colors and food preservatives; also many official analyses of foods and food products from the

State of Ohio; and much information of a legal nature concerning the adulteration of food in Pennsylvania.

The use and abuse of condiments, J. H. EGBERT (*Diet. and Hyg. Gaz., 12 (1896), No. 5, pp. 285, 286*).—A popular article on the subject.

The feeding value of ensiled sugar-beet diffusion residue, A. BĚLOHOUBEK (*Abs. in Chem. Ztg., 20 (1896), No. 28, Repert., p. 85*).—Range in composition of material after ensiling 6 months.

The physiology of the carbohydrates, F. W. PAVY (*London: J. & A. Churchill, 1895, pp. XVI, 141*).—This book is a reply to Paton's criticism of Pavy's earlier work on this subject.

Metabolism experiment on sheep with a Pettenkofer respiration apparatus, F. LEHMANN (*Jour. Chem. Soc., 1896, Apr., p. 262*).

The variation in nitrogen excretion in the urine after eating, B. TSCHLENOFF (*Cor.-Bl. schweiz. Aerzte, 1896; abs. in Chem. Ztg., 20 (1896), No. 22, Repert., p. 67*).—The author finds that the excretion of nitrogen in the urine after eating bears a definite relation to the amount absorbed in the digestive tract. The hourly determination of the nitrogen in the urine furnishes information concerning the amount absorbed in the stomach and the intestines. Absorption in health and disease, when peptone and meat are consumed, is discussed.

Slaughter tests with cattle, B. MARTINY (*Mitt. deut. landw. Ges., 1896, No. 4, pp. 28, 29*).—The test included 27 Shorthorn, 28 Simmenthaler, and 28 Holland steers. No differences peculiar to either breed were found. In each breed some gave better results than others on the same feed. On the size of the parts of the body, the live weight, the dead weight, and the weights of the separate parts, the author says the test gives information with a completeness and uniformity not heretofore attained.

Ceylon's little oxen (*Indian Agr., 21 (1896), No. 2, p. 57*).—An account of a diminutive breed of cattle used for express purposes in Ceylon. The height never exceeds 30 in. The weight of a specimen 22 in. high was a little over 109½ lbs. They have been known to travel 100 miles in a day and night without food or water.

Hygiene of domestic animals in milk production, C. PAGÈS (*Hygiène des animaux domestiques dans la production du lait. Paris: Masson, 1896, pp. 324*).

Hog raising, T. BUTLER (*Mississippi Sta. Bul. 35, pp. 125-148*).—This is a popular article dealing with breeds, selection of stock, care, and feeding. A number of breeds are described and the most frequent objections enumerated. The selection of breeding stock, care and management of the boar and brood sow, care of the pigs, feeding of breeding animals, pork production, and hog cholera are discussed at some length. The author urges the importance of using improved breeds of hogs and of better methods of care.

Winter feeding, with especial reference to the influence of the principal feeding stuffs and a consideration of which fodders furnish the necessary nutrients most cheaply, H. GRAFE (*Ztschr. landw. Ver. Hessen, 1895, No. 52, pp. 425-427; 1896, Nos. 1, pp. 3, 4; 2, pp. 11-13; 3, pp. 19-22; 4, pp. 27-29; 5, pp. 38, 39; 6, pp. 47-49; 7, pp. 55, 56; 8, pp. 68, 69*).—A popular article on the subject.

Poisoning fish ponds, P. ZIPSY (*Jour. Agr. Prat., 60 (1896), No. 8, pp. 292, 293*).

VETERINARY SCIENCE AND PRACTICE.

Investigation of bovine tuberculosis, M. STALKER and W. B. NILES (*Iowa Sta. Bul. 29, pp. 211-286, pls. 5*).—This bulletin presents, in a popular manner, information on the subject of tuberculosis, chiefly in reference to cattle, conclusions drawn from tests and experiments made at the station, and tables showing the temperature records of a large number of tuberculin injections. The nature of tuberculosis is briefly discussed, the tuberculin test explained, and the method of applying it detailed. The results of experiments made at various agri-

cultural experiment stations and by the Bureau of Animal Industry of this Department are briefly summarized, and the uncertainty of tests other than that by means of tuberculin, such as the milk test and physical examination, is insisted upon.

It is stated that tuberculosis has been known to be present in Iowa for over 25 years and now is found in all parts of the State. In 50 herds tested in 9 different counties of the State, out of 873 animals that were injected with tuberculin 122 gave distinctive temperature reactions and were found tuberculous on *post-mortem* examination. The methods of infection and the influence of herd management on extending the disease are discussed and some of the symptoms of the disease are elaborated. The question of the relation of meat and milk supply to public health is briefly taken up, and instances are cited in which tuberculosis was undoubtedly conveyed to human beings by means of milk from tuberculous cattle. It is urged that the disease can only be exterminated and healthy herds secured by slaughtering all cattle that are tuberculous, no matter to how slight a degree.

In 6 of the tables detailed data showing the pronounced temperature variation in diseased herds after tuberculin injections are given, while in 2 tables the slight temperature variation of healthy cattle is shown. Two other tables show the amount of rise in temperature following repeated injections, the maximum rise, and the location of lesions discovered on *post-mortem* examinations. It is urged that the normal temperature be carefully considered, as other influences than that of tuberculin injection may produce marked changes. The plates illustrate diseased cattle and tuberculous organs.

Foot-and-mouth disease, F. UHLRICHS (*Deut. landw. Presse, 23 (1896), No. 15, pp. 119, 120; No. 16, p. 132*).

Infection experiments with the anthrax of swine, ST. V. RÁTZ (*Centbl. Bakt. und Par. Med., 19 (1896), No. 9-10, pp. 305-307*).

Hematuria, BOSSFLIN (*Ind. Lait., 21 (1896), No. 7, p. 51*).

Concerning malignant œdema of cows, H. HORNE (*Norweg. Veterinær Ztschr., 1895, p. 65; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, p. 67*).

Prophylaxis of bovine tuberculosis, E. NOCARD (*Ann. Sci. Agron., ser. 2, 1896, I, No. 1, p. 139*).

Immunity against tuberculosis and tuberculosis antitoxin, F. NIEMANN (*Centbl. Bakt. und Par. Med., 19 (1896), No. 6-7, pp. 214-216*).

Tuberculosis in the domesticated animals, DELÉPINE (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 893-896*).—An address before the Lancashire Veterinary Medical Association.

Rabies and hydrophobia (*Field, Farm, and Garden, 87 (1896), No. 2256, p. 454*).—A brief discussion of the symptoms and *post-mortem* appearances of this disease, especially in the case of deer and dogs.

Cripple disease among dairy cattle, H. W. POTTS (*Austr. Farm and Home, 5 (1896), No. 2, pp. 57, 58*).—Notes on an outbreak of osteomalacia about Euroa, Australia, which is believed to be due to lack of lime in the soil, dry pasturage, and drought conditions. Green and other nutritious soft food, salt, and lime in the water are recommended.

Lameness of swine (*Deut. landw. Presse, 23 (1896), No. 20, p. 171, fig. 1*).

On the differential diagnosis of the microbes of swine fever and chicken enteritis, E. KLEIN (*Abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 66, 67*).

Parasites of poultry, F. V. THEOBALD (*Jour. [British] Bd. Agr., 1896, No. 4, pp. 420-436*).

Parasitic diseases and parasitic animals and plants, exclusive of bacterial, R. BLANCHARD (*Traite gen. Pathol., 2 (1895), pp. 649-932, figs. 70; abs. in Centbl. Bakt. und Par. Med., 19 (1896), No. 11, pp. 400-404*).—The abstract seems confined to the animal parasites.

A treatise on animal and vegetable parasitism as applied to medicine, R. MONIEZ (*Paris: 1896, pp. 680, figs. 11; abs. in Centbl. Bakt. und Par. Med., 19 (1896), No. 11, pp. 404-406*).—Only that part referring to animals is abstracted.

Instructions issued by the German Government for the disinfection of places where animals suffering from infectious diseases have been kept (*Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 55-57*).

DAIRYING.

Bacteriological and chemical studies on the spontaneous curdling of milk, C. GÜNTHER and H. THIERFELDER (*Arch. Hyg., 25, No. 2, pp. 164-195*).—The object was to determine whether the spontaneous curdling of milk was invariably due to one and the same form of bacteria, or whether it might be caused by numerous forms; and also to determine the nature of the acid causing the curdling. Eight samples of milk bought of different dealers and at different times from June to November were allowed to sour spontaneously, and then examined by means of plate cultures. From these samples 14 different forms of acid forming bacteria were isolated. Chemical examination of the sour milk showed that the acid was not always the optically inactive form, but often a mixture of inactive and dextro rotary lactic acid. Similar examination of 9 other samples of sour milk from various sources showed some to contain only inactive lactic acid, and some a mixture of inactive and dextro rotary acid, while in 2 cases the acid was purely dextro-rotary. Laevulo rotary acid, alone or in mixture, was not found in any case. The action of these 14 pure cultures in sterilized milk was observed, and all were found to sour and curdle the milk energetically. The acid produced was found to be pure dextro-rotary lactic acid in every case.

These bacteria were then studied morphologically in various cultures, and were found to be identical. In other words, only one form was found in spontaneously soured milk, and it is believed quite likely that this is identical with Lister's *Bacterium lactis* and Hueppe's *Bacillus acidi lactici*. The characteristics of the form are given. The authors have no explanation to offer for the fact that the acid produced in sterilized milk by the pure culture was invariably dextro-rotary, while in milk soured spontaneously the acid was usually inactive or a mixture of inactive and dextro-rotary lactic acid.

Bacteriology and the dairy, E. G. STERNBERG (*Sidney Mail; reprinted in Dairy, 1896, No. 88, p. 97*).—This is a semipopular article on the relation of bacteriology to dairying, and especially on the use of pure cultures in ripening cream for butter making. The following is

given as a result of a circular letter sent by the Royal Agricultural Academy of Sweden to about 100 dairymen in Sweden who had ordered and received pure cultures from the Academy.

"Seventy-one answers were very readily received, and out of the 71, 66 had ordered pure cultures owing to producing a more or less faulty butter, and only 5 had ordered them in scientific interest. In the 66 cases of faulty-butter production, the fault disappeared entirely in 52 cases (79 per cent) immediately on adopting the pure-culture system, in 7 cases the fault disappeared after some time, in 1 case it did not altogether succeed, and in 6 cases the pure cultures were declared unsuccessful. The quality of the butter produced when using pure cultures became in most cases very satisfactory, and in 2 cases where the experiments were undertaken in scientific interest a butter of still higher quality was produced, especially with regard to its keeping capacity."

The replies stated that with pure cultures the cream ripened more regularly and in a shorter time, and the butter was of more uniform quality.

Method of milk testing used at Kiel Dairy Experiment Station in paying for milk according to fat content, and the question whether milk samples should be preserved, H. TIEMANN (*Milch. Ztg.*, *21 (1895), No. 11, pp. 716-718*).—The method adopted for determining the fat rapidly is what is termed the Wollny method. It depends on the refractive index of an ether solution of the fat, as observed in the Wollny milk fat refractometer. In the test 25 or 30 cc. of milk is mixed with 3 or 4 drops of glacial acetic acid, 5 or 6 cc. of ether saturated with water at 17.5° C., and 1 to 2 cc. of potash solution, and vigorously shaken for 5 to 8 minutes in a shaking machine. The potash is prepared by adding to 250 cc. of 1 to 1 potassium hydrate, 100 cc. of glycerin, 150 cc. of water, and 50 gm. of copper hydrate, and shaking until the latter is dissolved. A little of the ether fat solution is filled in the Wollny refractometer, which is so arranged that the solution can be kept at a temperature of 17.5° C. by running water. The refractive index readings are converted to percentages of fat in the milk by means of a table.

In 27 comparisons with gravimetric analysis, using whole milk and skim milk, the results agreed within less than 0.1 per cent, the average percentage of fat by the gravimetric method being 2.803 and by the Wollny method 2.794.

According to the plan prescribed by the station for paying for milk by the fat content, samples of 25 cc. each are taken several times a month for testing, or samples of 10 cc. are taken 3 times during the month and mixed, giving a composite sample. The question was studied whether a preservative should be used in this composite or whether the fermentation of the milk resulted in a change in the fat.

A number of experiments are reported with the milk of different cows kept 3 and 4 weeks and with milk inoculated with various yeasts, molds, peptonizing and liquefying bacteria, etc., and kept at ordinary temperature and in a breeding oven.

The differences between the fat content at the beginning and end were almost invariably small, rarely exceeding 0.05 per cent. The conclusion is reached "that no change took place in the fat, and any products formed during fermentation had no appreciable effect on the refraction of the light. Consequently a preservative is unnecessary with the method of fat determination used."

Boric acid in butter (*Dairy, 1896, No. 87, p. 60*).—A discussion of the advisability of using this preservative in butter, with quotations from physicians and others as to the effect of consuming boric acid.

On the regulation of the proportion between cream and skim milk in centrifugal creaming, LIEBIG (*Molk. Ztg., 10 (1896), No. 9, pp. 129, 130*).—The object of this is to obtain cream of the desired concentration. The method of determining the proportion of cream to skim milk by means of measuring cylinders is described and directions given for making a scale to show the percentage of the cream.

Cheddar cheese making, J. BENSON (*Farm and Home, 14 (1896), No. 730, p. 569*).

The importance of bacteriology to dairying, KNEBEL (*Fuhling's landw. Ztg., 45 (1896), No. 3, pp. 90–95*).—A semipopular article pointing out the important part which microörganisms take in the fermentation of dairy products, in influencing the flavor of products, etc., and the progress made in controlling their action.

Butter making in England and Denmark (*Field, Farm, and Garden, 87 (1896), No. 2256, pp. 416, 417*).

The ripening process of cheese, V. VON KLECKI (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 1, pp. 21–33; Nos. 2–3, pp. 61–77*).—This is a comprehensive review of the published work on the chemistry and bacteriology of the ripening of cheese.

Diseases caused by unwholesome milk, G. G. GOFF (*Agriculture of Pennsylvania, 1894, pp 133–140*).—Discussion of milk as a vehicle for disease germs, with citations from numerous published accounts of disease outbreaks traced to milk and dairy products. As a means of securing more uniformly wholesome milk, the author suggests (1) popular instruction of producers and handlers of milk on the liability of milk to become contaminated, and (2) a system of dairy inspection regulated by State law.

TECHNOLOGY.

The tannin value of some North American trees, H. TRIMBLE (*Garden and Forest, 9 (1896), No. 426, pp. 162, 163*).—A report is given of analyses of the bark of a number of conifers to show their tannin content. The locality is the place from whence the sample came and may not represent the place where the trees are native.

Analysis of barks of some American trees.

Barks.	Locality	Moisture.	Ash.	Tannin.
		Per cent	*Per cent.*	*Per cent.*
Taxus canadensis	Pennsylvania	10.80	5.04	20.46
Taxus baccata	India	14.38	6.19	22.83
Libocedrus decurrens	Oregon	6.17	2.24	7.14
Thuya occidentalis	Philadelphia	5.61	6.46	6.13
Thuya gigantea	do	6.93	6.10	8.16
Cupressus thyoides	New Jersey	34.75	2.88	4.44
Juniperus virginiana	Philadelphia	8.04	6.30	7.30
Juniperus californica	California	5.57	9.23	8.10
Juniperus occidentalis	Oregon	7.72	5.60	5.17
Juniperus communis	Philadelphia	5.95	6.49	5.66
Taxodium distichum	Alabama	6.61	3.88	4.28
Sequoia sempervirens	California	7.99	0.64	1.63
Sequoia gigantea	do	6.45	0.37	2.77

The starch industry and manufacture in the United States and its influence on the English market, O. SAARE (*Berlin: J. Springer, 1896, pp. 120, figs. 8*).

French sugar factories and their methods (*Sugar, 8 (1896), No. 5, pp. 1, 2*).

Theoretical yield of masse cuites (*Sugar Cane, 28 (1896), No. 320, pp. 116–118*).

A contribution to the study of the production of the aroma in rum, P. H. GREG (*Sugar Cane, 28 (1896), No. 320, pp. 141–145*).

Chemical nature of the wines of New South Wales, I, F. B. GUTHRIE (*Agl. Gaz. N. S. Wales, 6 (1895), No. 12, pp. 905–907*).—Notes on the Cawarra wines with tabulated analyses.

New perfumery products, J. N. GERARD (*Garden and Forest, 9 (1896), No. 421, pp. 112, 113*).—Notes on the synthetic chemical production of perfumes simulating the odors from various flowers.

Ramie fiber (*Ztschr. Nahr. Untersuch. und Hyg., 10 (1896), No. 7, p. 90*).—A very brief reference is given to an improved method of preparing ramie fiber for spinning which is described in *Genie Civil, 1895, No. 15*, and quoted in *Wochenschr. d. niederoster. Gewerbe-Vereins, 1895, No. 2*.

The determination of the heating effects of coals, W. A. NOYES, J. R. MCTAGGART, and H. W. CRAVER (*Jour. Amer. Chem. Soc., 17 (1895), No. 11, pp. 843–849*).—The paper is a discussion of the uses of the calorimeter, Berthier's test, and calculation from analysis for determining the heat value of coals. The authors conclude that the calorimeter is the most accurate and reliable.—H. J. PATTERSON.

AGRICULTURAL ENGINEERING.

Electricity in agriculture, F. BRUTSCHKE (*Deut. landw. Presse, 23 (1896), No. 12, pp. 93, 94, figs. 4*).—An experiment was tried among the small landholders near the city of Greifenhagen, in Pomerania, in using an electromotor to run a threshing machine. Thirty pfennigs (7½ cts.) per horsepower was charged for the power used.

A comparison was made between the cost of driving the thresher by electricity and by horsepower. The cost of 8 hours' work with the motor was 7.2 marks ($1.83), and with the horsepower 20 marks ($4.80). The work accomplished by the electric motor was 16.6 per cent greater than by horsepower. This the author attributes in the main to the greater uniformity in the number of revolutions of the cylinder per minute when driven by the motor.

The author thinks that electric power could be furnished from large plants at one-half the price paid in this experiment, *i. e.*, at 12 to 15 pfennigs (3 to 3¾ cts.) per horsepower, and that its most important use in agriculture will be in plowing.

Illustrations are given of the application of electricity to threshing, lighting fields at night for increasing the number of hours of work per day at critical times, and for sawing wood.

Electricity in agriculture, BRETSCHNEIDER-HOPPENRADE (*Landw. Wochenbl. Schles. Holst., 46 (1896), No. 3, pp. 37–40*).—The author describes his plant, and speaks of the advantages of having a power at hand at an instant's notice for threshing, etc., during bad weather and for lighting.

The central electrical station on the Upper Spree and its usefulness for the surrounding agricultural community, F. BRUTSCHKE (*Deut. landw. Presse, 23 (1896), No. 21, p. 180, figs. 2*).

Practical irrigation in Kansas, C. D. PERRY (*Irrigation Age, 9 (1896), No. 3, pp. 120-122, fig. 1*).

History of irrigation in Nebraska, I. A. FORT (*Irrigation Age, 9 (1896), No. 3, pp. 123-125*).

Irrigation in South Dakota, J. M. GREENE (*Irrigation Age, 9 (1896), No. 3, pp. 125, 126, fig. 1*).

Irrigation by furrows, T. S. VAN DYKE (*Irrigation Age, 9 (1896), No. 3, pp. 115-119, figs. 3; No. 4, pp. 153-156*).

Irrigation by flooding, T. S. VAN DYKE (*Irrigation Age, 9 (1896), No. 5, pp. 192-196, figs. 2*).

Pump irrigation on the plains, H. V. HINCKLEY (*Irrigation Age, 9 (1896), No. 5, pp. 185-192, figs. 9*).

Irrigation through tile drains (*Rural New Yorker, 1896, Apr. 18, p. 269, figs. 3*).—An account of experiments by King at Wisconsin Station in 1894.

Measurement of streams, gauging the underflow, F. C. FINCKLE (*Irrigation Age, 9 (1896), No. 3, pp. 111-115*).

The development of underflows, F. C. FINCKLE (*Irrigation Age, 9 (1896), No. 4, pp. 157-160*).

Storage reservoirs and dam sites for irrigation, F. C. FINCKLE (*Irrigation Age, 9 (1896), No. 5, pp. 197-199*).

Agriculture and agricultural machines in the United States, GILLE and LELARGE (*Paris: Bernard et Co.*).

Agricultural machines at the Palace of Industry, M. RINGELMAN (*Jour. Agr. Prat., 60 (1896), 1, No. 14, pp. 493-499, figs. 5*).

STATISTICS.

On the computation of the cost of production in agriculture, A. KRÄMER (*Landw. Jahrb. Schweiz, 1893, pp. 370-393*).—The author considers the correct application of business calculations in agriculture much more difficult than in any other line of business. In most cases a common measure can not be applied to all the items of expense and production; and by reason of the complicated relations of the different parts of the business it is often a doubtful and difficult matter to pick out a particular article in the course of the internal exchange, to separate it from other things with which it has an intimate and dependent relation, and to assign to it an independent value. Among the prominent questions of agricultural bookkeeping must be placed the cost of production. Interest must be charged on the capital invested, and the personal services of the owner charged at the rate which they would command in another's employ in the same capacity. Illustrative examples are given in detail of the method of procedure in general, and in particular as to the cost of production for northeastern Switzerland of 1 kilocentner of wheat, 19 francs 56 centimes (for the United States 11 francs 35 centimes); of air-dry meadow hay, 6 francs 67 centimes; of 1 liter of milk, 12.15 centimes. The difficulties in getting at such results and the advantages to be obtained from them are discussed at length. The author advocates a diversified agriculture, with such specialization as the surrounding conditions render most profitable.

Agricultural statistics of Norway, 1886–'90, A. N. KIAER (*Norges Offic. Statist. III Raekke, No. 217. Christiania: 1895, pp. XLII, 296*).—The report gives the results of the last census of Norway, and in the summary and conclusions recapitulates the statistical data for crops and farm animals in Norway since 1835. It is noticed that the total area of arable land in 1890 was 231,446 hectares (571,903 acres), which is only 7 per cent, or $\frac{1}{10}$ part, of the total area of the country. In the table given below some of the main data concerning the crops grown are summarized. The original figures are in the metric system.

Data relating to farm crops in Norway, 1886–'90

	Area occupied by various crops	Total production	Average yield per acre	Per cent of various cereals sown	Average seed sown per acre
	Acres	*Bushels*	*Bushels*	*Per cent*	*Bushels*
Wheat	10 840	263 800	24.34	1.6	3.3
Rye	34 000	948 400	27.89	3.6	2.3
Barley	127 900	4 225 000	33.01	22.1	3.7
Barley and oats mixed	35 080	1 442 000	41.10	8.0	4.9
Oats	241 500	9 815 000	40.64	63.3	5.7
Peas	9 010	228 000	25.31	1.4	3.5
Potatoes	96 680	23 950 000	247.80		34.0

The potato crop stands first in value; then comes oats, barley, barley and oats mixed, rye, wheat, and peas, in the order given.

The following number of farm animals were enumerated in January, 1891: Horses 150,898, cattle 1,006,499, sheep 1,417,524, goats 272,458, swine 121,057, reindeer 170,134. Of the cattle, 17.8 per cent were under 1 year old, 10.6 per cent were between 1 and 2 years old, 71.6 per cent were above 2 years old; of the latter, again, 98.1 per cent were milch cows. There were 796,563 chickens, 5,446 ducks, 4,840 geese, 1,516 turkeys, and 17,216 beehives in the country in January, 1891.

The average value per head of farm animals was as follows: Working horses, \$69.13; oxen, \$24.44; cows, \$23.61; young cattle, \$12.99; calves, \$3.67; full grown sheep, \$3.30; goats, \$2.84; swine, \$16.69. The average annual yield of milk per cow was, in 1875, 2,506 lbs.; in 1880, 2,540 lbs.; in 1885, 2,579 lbs.; in 1890, 2,667 lbs. The average milk yield among the more intelligent class of farmers was 3,590 lbs. per cow per year. The best average milk yield for any single county was 3,762.5 lbs., and 4,913.8 lbs. for the best dairies within the county; for the county making the poorest showing the figures were 2,182 lbs., and 2,762 lbs. per head per year.

The average price paid for full milk was 9.98 öre per liter (about \$1.17 per 100 lbs.), and for butter 1.59 kroner per kilogram (19.4 cts. per pound).

There were 276 creameries and 31 cheese factories in operation in 1890. Of the former, 58 took in less than 100,000 liters during the season (1 liter = 2.27 lbs.), 68 took in between 100,000 and 200,000 liters, 73 between 200,000 and 500,000 liters, 19 between 500,000 and 1,000,000 liters, 4 between 1,000,000 and 2,000,000 liters, and 2 over 2,000,000 liters.

The total quantity of milk handled by 224 creameries making butter largely was 60,422,651 liters, from which 1,393,092 kg. butter, 108,477 kg. full-cream cheese, and 1,340,643 kg. of skimmed cheese were manufactured. One hundred and ten creameries were separator creameries. The cheese factories, 29 of which were coöperative factories, took in 4,984,699 liters of milk in the aggregate, making 407,021 kg. of full-cream cheese and 223,932 kg. of skimmed cheese. Of the latter quantity 81,463 kg. were enriched "mysost" (whey cheese).—F. W. WOLL.

Seventh Annual Report of Indiana Station, 1894 (*Indiana Sta. Rpt. 1894, pp. 53*).—This consists of reports by the director, chemist, botanist, veterinarian, horticulturist, and agriculturist, giving brief reviews of the work of the year in the several departments; a treasurer's report for the fiscal year ending June 30, 1894; and reprints of the press bulletins issued by the station during the year

The world's markets for American products—Belgium (*U. S. Dept. Agr., Section of Foreign Markets Bul. 6, pp. 90*).—Among the topics treated are area and population, agriculture, fisheries, manufacture, wealth, commerce, and prices of agricultural products. The report of the consul at Ghent is given.

Monthly crop report, December, 1895 (*U. S. Dept. Agr., Division of Statistics Rpt. 133, n. ser., pp. 36*).—Report on the product and value of the principal crops by States, final estimates of average farm price of various agricultural products. Meteorological record April to September, report of European agent, and transportation charges are given.

Statistics of Ontario (*Ontario Dept. Agr. Bul. 55, pp. 21*).—Giving the statistics of the farm crops, live stock, dairy products, population, assessed values, debts, and municipal statistics for the Province of Ontario.

Crops and live stock in Ontario (*Ontario Dept. Agr. Bul. 56, pp. 16*).—Contains final estimate of yield of crops in Ontario for the year 1895.

Agricultural conditions in Iceland, I. THORARENSEN (*Landmandsvennen, 3 (1895), pp. 135-138*).

On the production and consumption of our most important crops, G. SUNDBARG (*Kgl. Landtbr. Akad. Handl. Tidskr., 34 (1895), pp. 281-278*).—A complete summary of the world's production of agricultural crops, with detailed statistics of Swedish agricultural production and consumption.

Annual Report of the Commissioner of Agriculture of Norway for 1894, (*Kristiania: 1895, pp. XLI, 398*).—The report contains the usual accounts of the work done during the year by the government through its various functionaries for the advancement of Norwegian agriculture.

The market for Danish butter and bacon, H. TABER (*Tidsskr. Landokon., 14 (1895), pp. 411-468*).—An address delivered before an agricultural convention in Aarhus, Jutland, October 5, 1895, giving statistics of Danish exports, prices paid, and discussing the dangers of competition, especially in the English market.

Number of farm animals in Denmark July 15, 1893 (*Maanedsskr. Dyrläger, 7 (1895), pp. 10-12*).—Official statistics show that Denmark had 410,639 head of horses and colts on July 15, 1893, 160 asses, 1,696,190 head of cattle and calves, 1,246,552 sheep and lambs, 25,266 goats, 829,131 swine. There were 751 head of cattle per 1,000 inhabitants, Denmark ranking thus third in this respect, Ireland ranking first, with 949 head, and the United States 848. There were 5,855,999 fowls (ordinary barnyard fowl), 40,512 turkeys, 723,708 ducks, and 230,396 geese. There were 122,492 beehives in 1893.

Finland's butter export, 1866-'94 (*Tidn. Mjolkhushållning, 4 (1895), p. 110*).—The following figures show the increase in the exportation of butter from Finland during the last 29 years: In 1866, 2,029 tons; 1871, 4,826; 1876, 5,484; 1881, 4,942; 1886, 5,196; 1891, 7,963; 1894, 13,334. Nearly 90 per cent was exported to Denmark and England and the rest largely to Russia.

Report of the Royal Danish Agricultural Society, 1894-'95 (*Copenhagen: 1895, pp. 148*).—The usual account of the various activities of the society.

A history of Danish agriculture, C. C. LARSEN (*Det Danske Landbrugs Historie. Copenhagen: P. G. Philipsen, 1895, pp. 186*).

Report of the public measures for the advancement of agriculture (*Christiania, Norway, 1895, pp. XLI, 398*).

On a reform of the grain trade, J. KLAPPER (*Fühlings landw. Ztg. 45 (1896), Nos. 2, pp. 41-44; [illegible], pp. 77-87, chart 1*).—The chart gives an interesting comparison between the prices of grain and bread from 1881 to 1895.

On the injury to agriculture by the smoke from factory chimneys, M. HAGEN (*Chem. Ztg., 20 (1896), Nos. [illegible], p. 2[illegible]; [illegible] p. [illegible]*).

NOTES.

ARIZONA STATION.—The substations at Mesa and Willcox have been discontinued.

NEW YORK CORNELL STATION.—A. N. Prentiss, who for over 20 years has been at the head of the department of botany in Cornell University and botanist of the experiment station since its organization, has been compelled, on account of failing health, to resign his position. G. F. Atkinson has been promoted to the position vacated by Professor Prentiss.

The State legislature has recently appropriated the sum of $16,000 to be expended by the Cornell University Experiment Station in the fourth judicial district of the State. This money will be used for investigations along the line of horticulture and for disseminating horticultural information.

OHIO STATION.—The General Assembly of Ohio, at its biennial session just closed, has appropriated $58,300 for the use of the State Experiment Station during the 2 years 1896 and 1897.

Previous appropriations for the equipment and work of the station since its removal to its permanent location in 1892 amount to a total of $139,000, making a total for 4 years of $197,300.

On May 15 the board of control of the station contracted for the erection of a fireproof stone building for the administrative offices, museum, and library of the station. The completed cost will be about $37,000. The fireproof chemical laboratory is now nearly completed, the total cost having been about $15,000.

L. M. Bloomfield has been elected assistant chemist and C. W. Mally assistant entomologist of the station. These gentlemen have occupied similar positions at the Ohio State University and the Iowa Experiment Station.

At its last biennial session the General Assembly of Ohio passed an act for the prevention of the spread of peach yellows, black knot, and San José scale, in which the experiment station is made the final referee in case of dispute concerning the nature of the tree disease.

SOUTH DAKOTA STATION.—The following changes have been made in the station staff of this station, and the change ordered to go into effect May 1: James H. Shepard was made director and chemist, vice Lewis McLouth and R. L. Slagle, relieved. E. C. Chilcott was made agriculturist, vice E. A. Burnett, relieved. Messrs. Slagle and Burnett will devote their entire time to college work.

TEXAS STATION.—W. D. Clayton is acting assistant meteorologist.

WASHINGTON AGRICULTURAL COLLEGE AND SCHOOL OF SCIENCE.—The first annual session of the Washington Dairy School was attended by 22 students; the lines of instruction being butter making, cheese making, milk testing, pasteurization, feeding and care of live stock, care of apparatus, etc. Most of the students are now engaged in dairying in the State.

The recent winter school for farmers, consisting of two weeks of lectures on various farm topics, was attended by 254 farmers.

HALLE EXPERIMENT STATION.—This station has added to its plant an experiment farm of about 125 acres, and a meadow of about 12 acres, with buildings. This is to be used in carrying on field experiments on a large scale, feeding experiments, experiments on the production and value of manure, etc. For the maintenance of this experiment farm the Prussian Minister of Agriculture, Domains, and Forestry has added 25,000 marks (or $6,000) to the annual income of the station.

EXPERIMENT STATION RECORD.

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In connection with investigation of the laws of nutrition and their application to the economy of the food and feeding of man and domestic animals, of feeding and the use of food, studies of the changes which the nutrients of the food undergo in the body, and the ways they are utilized, are of fundamental importance. Such studies include respiration and metabolism experiments on live subjects, and have to do with some of the most intricate and difficult kinds of investigation. In the ordinary digestion experiment the nutrients consumed and those excreted in the dung are determined and the difference is taken as that digested. In experiments on the metabolism of nutrients the total income and outgo of materials are measured, and to do this it is necessary to take into account not only the nutrients digested and resorbed but also the oxygen used in respiration, and the excretions of both the kidneys and intestines.

Another phase of the question is the metabolism of energy. In studying this it is necessary to take into account the energy of the food and drink consumed and of the excretory products, the heat radiated and the exterior mechanical work performed. Experiments on the metabolism of matter must precede those upon the metabolism of energy, both because the former offer the more immediate and practical results and because the data they give are necessary as a basis for the other. The primary data are the amounts of nitrogen, carbon, hydrogen, and other elements involved in the bodily income and outgo. The starting point is the nitrogen balance.

The elaboration of methods for such investigation has been the work of years, and the apparatus used is among the most interesting devices of modern experimental science.

To facilitate reviewing the work already done in this line and comparing the results, a compilation of metabolism experiments with both man and animals is being made in this Office. A surprisingly large amount of data on this subject has been found, and already over one thousand such experiments with man, and about the same number with domestic animals, have been compiled. It is proposed to group this material under appropriate heads, according to the character of the

work, for more critical examination and study, and ultimately to publish at least a digest of the work, with discussion, in a bulletin. It is believed that such a review of this important line of investigation will throw much light on the accepted theories of nutrition, and may suggest new fields for profitable investigation.

The historical article in the present number of the Record reviews one of the fundamental questions concerning the excretion of metabolized nitrogen. This is intended to serve as an introduction to a subject to which the Office proposes in its nutrition investigations to devote a large share of attention in the future. In connection with these investigations it is planned to study the metabolism of nutrients and energy, using a modified form of apparatus, with a view to aiding in the elucidation of the laws and principles upon which real progress in the use of foods depends.

The institutions for agricultural education and research in Europe are to be the subject of personal study by a representative of this Office during the present summer. Dr. A. C. True will spend some time abroad, and will visit many of the more prominent of these institutions. The general systems of agricultural instruction in the different countries will be studied; and the equipment, courses of study, methods of teaching, etc., of the various kinds of agricultural schools and institutions will receive special attention. The administration and work of the experiment stations will likewise be investigated. In view of the inquiry undertaken by the committee on courses of study of the Association of American Agricultural Colleges and Experiment Stations, the collection of information in regard to agricultural education abroad would seem to be especially opportune. It is expected that the results of Dr. True's observations will appear later in publications of the Office.

THE EXCRETION OF METABOLIZED NITROGEN BY ANIMALS.

C. F. LANGWORTHY, PH. D.

The fundamental subject which underlies inquiry on the nutrition of animals, both abstract and practical, is metabolism, or the chemical and physical changes which matter and energy undergo within the animal organism. The processes of metabolism of matter include those by which the constituents of the food are transformed within the organism into more complex or simpler compounds which are used to build up the body and repair its wastes, and finally excreted when they are no longer useful to the organism. Parallel with these processes are those of the metabolism of energy, by which the potential energy of the food is changed into those forms of energy which are needed for physiological work within the body, *e. g.*, that of respiration, circulation, and digestion, for exterior muscular work, and for furnishing the heat which is necessary to maintain life.

In experiments upon the metabolism of matter in animals the essential feature is the balance of income and outgo. This may be expressed in terms of the raw materials, food and drink, the oxygen of inhaled air, and the excretory products, solid, liquid, and gaseous. It is also expressed in terms of chemical compounds of which these products are composed, *e. g.*, the water and nutrients of food and the excretory products which come from their metabolism. For accurate experimenting, however, the income and outgo must be determined by the quantities of chemical elements, nitrogen, carbon, hydrogen, oxygen, sulphur, phosphorus, etc. The metabolism of energy is expressed in terms of heat.

The importance of the nitrogenous compounds of the food makes the metabolism of nitrogen one of the most essential of the processes of nutrition. In all metabolism experiments, therefore, the determination of nitrogen is of fundamental importance. It is commonly assumed that where the nitrogen balance is measured by determinations of nitrogen in the food and drink on the one hand and of the excretions of the kidneys and intestines on the other, an accurate balance of income and outgo is obtained. It has, however, been claimed that some of the excretory nitrogen leaves the body in the form of gas; in other words, that some of the nitrogenous material of the food or of the body substance may be so decomposed in the body that nitrogen is liberated and leaves the body in the free state. If this supposition is correct, all of the experimenting thus far done is defective, and our whole theory of nutrition in so far as it is based upon inquiries in metabolism requires

revision. It is evident, therefore, that in order to get an understanding of the present status of the knowledge with regard to metabolism, and to devise and prosecute inquiries in this direction, it is desirable first of all to know the reasons for accepting or denying the theory that nitrogen escapes from the body in gaseous form in any considerable quantities.

As the study of metabolism has advanced, two opinions regarding the excretion of nitrogen have been bitterly fought for by their defenders. Voit and his followers of the Munich school have sought to prove that practically all excreted nitrogen leaves the body in the urine and feces. Seegen, of Vienna, and others have, on the other hand, insisted that considerable nitrogen may be excreted in the form of gaseous excretory products.

Voit's position may be briefly defined as follows: If the organism is in nitrogen equilibrium exactly as much nitrogen is excreted in the urine and feces as is consumed in the food, provided the animal does not gain or lose in weight. There is no chance for an excretion of nitrogen in the gaseous respiratory products. The discrepancies between income and outgo are attributed to unavoidable errors in experimental methods. That this reasoning can be depended upon, the balances of mineral matter, sulphur, and phosphorus would seem to prove, since in these cases there would manifestly be no question of a gaseous excretion.

Seegen believed that when a discrepancy occurred between the consumed nitrogen and that excreted in the urine and feces it was due to a gaseous excretion of nitrogen and not to errors in method, or might be wholly explained on the ground of a change in weight of the subject.

Some of the very early investigators, among others Regnault and Reiset and Boussingault, claimed to find proof of a gaseous excretion of nitrogen, although they did not place much weight upon the fact. Barral also found considerable discrepancy between consumed nitrogen and that excreted in urine and feces, which was accounted for on the ground of gaseous excretion, although no examination of respiratory products was made. Seegen quotes much of this early work made between 1830 and 1843 in proof of his position. Of the work of Boussingault[1] it may be said that for the time it was excellent, but it must be remembered that the methods of analysis of food products were not as exact as in later times, as is shown by an examination not only of Boussingault's but also of Barral's work. Barral made 6 dietary and metabolism experiments with men. The nitrogen content given for the meat multipled by the factor 6.25, gives in 4 of the 6 cases a protein content larger than the dry matter reported. This evidently indicates an error in the determination of either the nitrogen or dry matter, and throws doubt upon the inference that there was an excretion of gaseous nitrogen.

[1] Ann. Chim. et Phys., ser. 3, 25, p. 129.

The early respiration experiments of Regnault and Reiset,[1] which are often quoted by both Seegen and Voit,[2] were made along the lines pointed out by Lavoisier. An animal was confined for some time in a small, closed chamber. The carbon dioxid produced was absorbed and oxygen supplied as it was needed, and the air in the chamber was analyzed at the close of the experiment. Often a little more nitrogen was found in the air at the end than at the beginning, although the results were not at all regular, and the reverse was true in some instances. The determination of respiratory excretion of nitrogen was not the principal object sought in these experiments, and no account was taken of the nitrogen in food, urine, or feces.

The small gain of nitrogen did not apparently make any great impression on the experimenters or others at the time, but gained prominence many years later when all metabolism work was being examined to prove or disprove a theory. It may be accounted for otherwise than as a respiratory product. It is possible that the oxygen used may have contained a very little nitrogen. The oxygen was confined in a vessel over a solution of calcium chlorid, and nitrogen of the external air may have diffused into it through this liquid. A very probable source of error is found in the fact that the hair and feathers of the animals experimented upon mechanically inclose considerable nitrogen of the air. The stomach and other cavities of the body inclose air, and atmospheric nitrogen finds its way into the blood by diffusion. During the experiment this mechanically retained nitrogen might be liberated and increase the sum total in the chamber. The work of Hufner[3] is cited as furnishing proof of the probability of this source of an increase of nitrogen.

It is only since the discoveries of Ludwig[4] that it is possible to avoid an excess of free (atmospheric) nitrogen in the blood. Voit does not imply that all these sources of error were actually present in Regnault and Reiset's work. They are, however, probable sources of error which were not understood and guarded against at the time the experiments were made. There seem, therefore, to be many reasons why this work should have little weight in this nitrogen controversy

In 1863 Reiset published the results of some metabolism experiments with Herbivora, and included nitrogen among the respiratory products. The amount was not large and was determined by difference, not by actual measurement.[5]

In 1866 Seegen made a long series of investigations with a dog.[6] The food was meat, to which sodium carbonate was added in several instances.

[1] Ann. Chim. et Phys., ser. 3, 26, p. 106.

[2] Ztschr. Biol., 16, p. 511.

[3] Jour. prakt. Chem., 1874 (10), p. 1; 1875 (11), p. 13; 1876 (13), p. 292.

[4] Ztschr. Biol., 16, p. 513. Voit cites B. Ludwig's work.

[5] Compt. Rend., 56 (1863), p. 740.

[6] Studien über Stoffwechsel, Berlin, 1887, p. 77. (This is a collection of Seegen and Nowak's papers on metabolism, which appeared originally in Pflüger's Archiv., etc.)

Nitrogen in the food, urine, and feces was taken into account. When the period of observation was long, the amount of nitrogen consumed was much larger than that excreted in the urine and feces. Voit had held that such a gain could be explained as a gain in muscular tissue, pointing out that the gain in muscular tissue may be greater than the gain in weight, for muscular tissue can be stored up in place of fatty tissue present at the beginning but utilized during the experiment. Seegen maintained that the gain in nitrogen in long experiments was so great that it could not be explained as a gain in muscular tissue. He claimed, therefore, that some of the nitrogen was excreted in the gaseous products. However, he determined the amount thus excreted by difference and made no examination of the respiratory products. As determined by this method, the amount of nitrogen in the gaseous excretory products was very variable, under certain conditions almost all the nitrogen being excreted in the urine and feces, while under other conditions as much as half was unaccounted for by these. The conditions which cause this variation were not determined, although it appeared that sodium carbonate increased the amount of nitrogen in the urine.

The point raised by Seegen that a short period is of little value in settling the question of the excretion of nitrogen, is an important one. If for one or two days the nitrogen in urine and feces, is 1 gm. more or less than that in the food consumed, the variation may be easily explained by a gain or loss of muscular tissue. But if the difference is found to be constant, for instance for 100 days, the matter is different and a change in muscular tissue is not sufficient explanation. Seegen quotes one of Reiset's experiments with sheep.[1] This experiment lasted 168 days and was divided into 4 periods. There was an apparent gain of 3,072 gm. of nitrogen, and, as Seegen quotes the figures, the gain in weight was far from sufficient to account for this quantity. Voit points out that Seegen by an oversight quoted this gain of nitrogen as made during the third period, whereas it was really made during the whole experiment. He shows that the gain in weight during the whole period would account for a large part of it, and believes that errors in the analytical methods used would explain the remainder. For instance, the fodder consumed in the experiment was quite varied, including beets, oats, etc. The total nitrogen in it was calculated on the basis of a very few analyses. It is also probable that all the urine was not collected. Either of these conditions may be a source of considerable error.

Gruber made a series of experiments[2] with a dog, in which the nitrogen of the food, urine, and feces was determined with all possible care. The experiment covered 27 days. The total nitrogen consumed was 268.53 gm. The total amount excreted in the urine and feces was 268.28 gm. The difference between income and outgo is so small that it may

[1] Compt. Rend., 56 (1863), p. 569.

[2] Ztschr. Biol., 16, p. 379.

be disregarded, and there is no chance for a gaseous excretion of nitrogen. The fact that during a part of the experiment the sulphur balance was 12.77 gm. consumed and 12.78 gm. excreted in urine and feces is given as confirming the accuracy of the analytical methods used.

Voit has shown that it is of the utmost importance that the urine be collected directly in a suitable vessel, and not allowed to fall on the floor of the cage or stall in which the animal is confined during the experiment, and afterwards collected. He shows that the loss from failure to do this may be very considerable by the following comparison of 2 similar experiments with cows, one made by himself in which the urine was collected directly, and the other by Boussingault, who did not take this precaution:

Income and outgo of nitrogen per day with cows.

Author	Food		Milk		Feces		Urine	
	Dry matter	Nitrogen	Weight	Nitrogen	Weight	Nitrogen	Weight	Nitrogen.
	Kg	*Gm*	*Kg*	*Gm*	*Kg*	*Gm.*	*Kg*	*Gm*
Boussingault's experiment ...	10	201	8	46	28	28	8	36
Voit's experiment	13	234	9	48	20	30	22	94

The agreement between food, milk, and feces in each experiment and the amount of nitrogen in them is quite close, but there is a considerable difference in the case of the urine. The large discrepancy between consumed and excreted nitrogen in Boussingault's experiments has been explained as due to a gaseous excretion of nitrogen, but Voit did not find a discrepancy in his experiment which could indicate it, and it seems probable that the discrepancy in Boussingault's experiments is due to a failure to collect all the urine.

The fact that any considerable quantity of urine can be lost by collecting by the indirect method is disputed by Seegen. Actual experiments were made by him and by Voit, and the weight of evidence appears to be for Voit's view.

At first Voit believed that considerable nitrogen might be lost by the decomposition of urine on standing and the volatilization of the ammonia vapors thus formed. Seegen showed by experiment that this loss was very small, and in a later publication Voit yields the point and publishes results which confirm Seegen's view.[1]

Voit also emphasizes the need of being sure that the urine and feces belong to the food consumed during the experiment, and not to the period preceding or following it. If this can not be done with certainty, he adds, the experiment should be of long duration so that the error from this cause may be proportionally small. Another point raised is that an animal must be in nitrogen equilibrium before any conclusions can be drawn from the results.

[1] Ztschr. Biol., 4, p. 316.

These points, like many others, were not understood by earlier investigators, yet their work is apparently rated by Seegen as high as that of Henneberg, Stohmann, or others, who made corrections to cover such points.

Voit draws attention to the fact that many observers who find more nitrogen consumed than is excreted in the urine and feces find the same thing in the case of mineral matter, sulphur, or phosphorus. A respiratory excretion of these substances is, of course, not to be thought of, and it is insisted that results which are manifestly inaccurate in one particular should not be considered accurate in others, and quoted as proving a theory. The loss of mineral matter would most probably be due to a failure to collect all the excreta, and the same might be true with nitrogen.

An interesting feature of the nitrogen discussion is the work done by Seegen and Voit together. In the spring of 1868 or 1869 Voit went to Vienna and worked with Seegen for several weeks. Experiments were made with 2 dogs. Voit worked almost exclusively with the dog which had been used in Seegen's previous experiments and which was in nitrogen equilibrium. He collected the excreta in the way he had always recommended, *i. e.*, directly, and succeeded in obtaining uniform daily results. The excreted nitrogen agreed almost exactly with that consumed. Seegen's results showed considerable daily variation. It seemed as if Voit had finally settled the controversy and shown that Seegen's conclusions were based on errors due largely to the fact that he had not collected all the urine. No respiration experiments were made.

Two years later Seegen[1] published his account of these joint experiments. He insisted that he was never convinced by Voit and endeavored to show that Voit's objections to his methods of work were not well grounded. However, the fact remains that Voit got more uniform and consistent results than Seegen had previously obtained, and uniformity of results is an important factor. If there is a discrepancy in the nitrogen balance due to the respiratory excretion, it should be very nearly the same for each day, provided the food and other experimental conditions are constant. Seegen's deficit in the nitrogen balance had shown considerable variation, which would go to show that it was due to some error in manipulation and not to a bodily function.

It is very possible that the slight discrepancy in the results obtained by Voit, and which Seegen still claimed were due to respiratory nitrogen, may be explained by the fact that neither investigator took the precaution of analyzing the meat used as food. The nitrogen content was calculated from Voit's old figures for raw meat, 3.4 per cent. Analyses made by Nowak for Seegen seem to show that the nitrogen content of meat is quite variable, but generally higher than that assumed by Voit, and it is now recognized that there is a considerable source of error here.

[1] Studien über Stoffwechsel, p. 126.

Voit's experiment with a dove is often regarded as convincing proof of his position in the nitrogen controversy. This experiment lasted 124 days. The total nitrogen in the excrement was practically the same as in the food consumed; hence there was no ground for supposing any gaseous excretion of nitrogen. Seegen's criticism of this experiment is that Voit made his nitrogen determination of the peas by the soda-lime method, which, in his opinion, gives too low results, especially in the case of vegetable albuminoids. He claims, therefore, that the dove received more nitrogen in its food than appears from the figures, and that the balance obtained is incorrect. Work done in Voit's laboratory[1] has shown conclusively that the soda-lime method as there used gave positively accurate results, and indicates that his experiment must be credited.

Voit[2] quotes the respiration experiments made by Pettenkofer and himself[3] as additional proof of his position regarding nitrogen excretion. These experiments are severely criticised by Seegen,[4] who regards the results as inaccurate. The points questioned are principally the determinations of carbon dioxid and water, and the fact that an even balance is always found. Voit replies that it has been experimentally proved that the error in the determination of carbon dioxid was not greater than 1 per cent, and in the determination of water not more than 3 per cent. The discrepancies which were pointed out in some control experiments made with a stearine candle burning in the respiration apparatus are shown to be due to incomplete combustion.

The fact that the income and outgo in Voit's experiments always balance is a necessary one, since one term, the oxygen, is determined by difference. Although in Voit's experiments the oxygen was determined in this way, and so represented the combined errors of all the other determinations, it does not differ greatly from the calculated amount of oxygen required. Voit did not examine the respired air for an increase of nitrogen, as from his point of view this was unnecessary.

Seegen contends that there is always a greater or less discrepancy between the consumed nitrogen and that excreted in the urine and feces, which can not be explained on the ground of slight analytical errors, but must be regarded as due to gaseous excretion.

Seegen also made a series of respiration experiments,[5] using an apparatus like that of Regnault and Reiset of the "closed circuit" type, and examining the respired air in the chamber at the end of the experiment.

Thirty-two experiments were made with rabbits, dogs, doves, and fowls, lasting from 12 to 110 hours. An apparent gain in the respired

[1] Ztschr. Biol., 16, p. 379.
[2] Ztschr. Biol., 16.
[3] U. S. Dept. Agr., Office Expt. Sta. Bul. 21, p. 109.
[4] Studien über Stoffwechsel.
[5] Studien über Stoffwechsel, p. 238.

air of from 0.001 to 0.009 gm. of nitrogen per kilogram per hour is reported. This would mean in some of the experiments an actual gaseous excretion of 2 or 3 gm. of nitrogen.

Voit[1] has expressed the opinion that the results obtained in this work can not be depended upon, for the following reasons: Though Seegen improved on Regnault and Reiset's apparatus by providing mercury connections in place of rubber or cement and in this respect prevented a diffusion of external nitrogen, he did not eliminate all chance of error of this character. He kept his nitrogen in a tank over water on which there was a layer of oil, instead of over calcium chlorid solution. Voit[2] quotes experiments which show that when gas is kept over oil it is rendered impure by diffusion in a comparatively short time. Oil is not as good as calcium chlorid solution for preventing such a diffusion. Voit also remarks that the oxygen may have been impure as it was made from potassium chlorate and manganese dioxid. Seegen's reply[3] to these objections is that his oxygen was made fresh for each experiment, and that if the nitrogen found was due to impurities it should also have been found in the control experiments with an alcohol lamp in the apparatus, which was not the case. Though Voit has spoken of these control experiments as untrustworthy he has not said just why. Voit thought the most probable source of error in Seegen's experiments was the fact that the temperature was not the same in all parts of the apparatus. Experiments were made which showed that a variation of from 1 to 5° C. would account for all the respiratory nitrogen found. Seegen's respiration chamber was made of copper plate and would allow the heat produced in it to escape rapidly by radiation, and no precaution was taken to maintain a constant temperature.

Another source of error is found in the method employed in the analysis of the respiratory products. Seegen gives few details beyond saying that the Bunsen method was employed. As he does not publish many results it is not possible from his work to tell much of the limit of error. According to Voit the smallest error in gas analysis by the Bunsen method, when all possible care in manipulation is used, is 0.05 volume per cent. If 50 cc. of gas is used as a sample, and from this the nitrogen in a larger quantity is computed, the resulting error may be quite considerable.

A series of respiration experiments with rabbits was made by Leo[4] in Pflüger's laboratory, in which many of the errors pointed out by Voit were avoided. In this case the amount of gaseous nitrogen which could be claimed to be excreted in respiratory products was reduced to 0.00042 gm. per kilogram per hour. This is one-twelfth the value found by Seegen and Nowak, and would be equal to 0.01 gm. per kilo-

[1] Ztschr. f. Biol. 16, p. 515.
[2] Ztschr. f. Biol. 16, p. 516 et seq.
[3] Studien über Stoffwechsel, p. 281.
[4] Arch. ges. Physiol., 26 (1881), p. 218.

gram for 24 hours when calculated for dogs, or 0.55 per cent of the total excreted nitrogen. This quantity is so small that in the author's opinion it is of little practical account, and it would seem to be within the limit of unavoidable error.

A consideration of the work as a whole brings out two principal points:

(1) Before analytical methods were perfected a considerable discrepancy between the nitrogen consumed and that excreted was usually found. It was often too great to be accounted for on the ground of a gain in weight of the subject. The discrepancies were, however, not at all regular, and as methods have been perfected the amount has constantly decreased.

(2) In a considerable number of respiration experiments a gain of nitrogen, which was believed to come from gaseous respiratory products, was found in the respired air. Improved methods have greatly diminished the amount, and it is believed that errors in method or observation are sufficient to account for the remainder.

The majority of investigators to day share Voit's opinion that all metabolized nitrogen is excreted in the urine and feces. Furthermore, since the nitrogen of the feces is largely due to the undigested residue of the food the urine may without serious error be assumed to contain practically all the metabolized nitrogen.

In this review of the subject the plan has been to give the principal points which have been discussed by Seegen and Voit. Many things have not been referred to, but they have seemed of less importance than the points touched upon. Seegen's last publication was in 1881 (reprinted by him in 1887). Whether or not this concludes the discussion it is, of course, impossible to say. While Voit's work is open to criticism, on the whole it is remarkable for its consistency. The fact that his results are so harmonious is one of the strongest reasons for accepting his conclusions.

CHEMISTRY.

On the determination of ammoniacal nitrogen in commercial fertilizers, BÖTTCHER (*Chem. Ztg., 20 (1896), No. 17, p. 151*).—In view of the criticism of the recommendation of the Association of Agricultural Experiment Stations in the German Empire that the nitrogen in ammonium compounds in fertilizers be determined by distillation with magnesia, the author compared this method with that in which distillation with soda solution was followed on a number of samples of sulphate of ammonia and mixed fertilizers containing nitrogen in different forms. The results were practically identical by the 2 methods, and indicated that the criticism, raised chiefly by fertilizer manufacturers, that the results by the method recommended are too low, is without foundation in fact. The magnesia, however, must be as free as possible from carbonate, and the results indicate that distillation of the water extract of the fertilizer is preferable to direct distillation, the latter giving too high results in mixed fertilizers.

The citrate solubility of the phosphoric acid in bone meal and some other phosphates, A. SJÖSTRÖM (*Kgl. Landt. Akad. Handl. Tidskr., 34 (1895), pp. 265–275*).—Digestion of 5 gm. of bone meal containing 40 per cent of fine meal, 25.49 per cent of total phosphoric acid, 1.96 per cent of nitrogen, and 0.87 per cent of fat, in 100 cc. of Petermann's citrate solution at 38 to 40° C. gave 6.72 per cent of citrate-soluble phosphoric acid. The same meal extracted with ether gave 6.88 per cent; after incineration, 1.43 per cent.

A citrate solution prepared according to Wein,[1] containing 4.55 gm. of ammonia and 20.5 gm. of citric acid per 100 cc. as compared with 4.73 gm. of ammonia and 21.26 gm. of citric acid in Petermann's solution, gave 4.61 per cent of citrate-soluble phosphoric acid in the same sample of bone meal.

Using amounts of bone meal varying from 10 to 0.5 gm., the citrate-soluble phosphoric acid increased from 2.15 per cent with the largest amount to 16.18 per cent with the smallest. A constant was found from the results, which was used with a fair degree of accuracy in calculating the variation in solubility with the variation in the amount of material taken.

[1] Agr. Chem. Analyse, 1889, p. 186.

A sample of bone meal digested with glycerol alkali at 200° C., according to Gabriel's method,[1] showed 32.93 per cent of total phosphoric acid and 8.02 per cent of citrate soluble acid when 2 gm. was weighed out, or a percentage solubility of 24.4 per cent against 25.5 per cent in the original sample.

Five grams of the bone meal was treated with 100 cc. of a citrate solution somewhat more alkaline than Wein's, and 2.96 per cent of soluble phosphoric acid was found. Five grams each of fine meal and coarse meal were treated with the same solution, with the following results. Coarse meal, 2.21 per cent of citrate soluble phosphoric acid; fine meal, 3.35 per cent.

The results of varying the length of digestion and the temperature are shown in the following table.

Influence of length and temperature of digestion on citrate solubility of phosphoric acid.

Length of digestion	Citrate soluble phosphoric acid	Percentage solubility	Temperature of digestion	Citrate soluble phosphoric acid	Percentage solubility
	Per cent.		*Degrees C.*	*Per cent.*	
2 hours	[illegible].78	[illegible]4	[illegible]0	8.10	26.4
1 hour	7.13	[illegible]3	40	[illegible].13	23.3
½ hour	6.[illegible]	1	[illegible]3	[illegible].59	21.5
			1[illegible]	[illegible].[illegible]0	19.6

A solution containing the theoretical amounts of ammonia and citric acid for tri-ammonium citrate gave slightly lower results than that used in the other experiments.

Similar experiments were made on 2 samples of Thomas slag, (1) containing 18.04 per cent of phosphoric acid and 85 per cent of fine meal, and (2) 16.34 per cent of phosphoric acid and 75 per cent of fine meal. The results were as follows:

Influence of weight of sample on citrate solubility of phosphoric acid.

Weight taken	Citrate soluble phosphoric acid		Percentage solubility	
	Sample 1.	Sample 2.	Sample 1.	Sample 2.
	Per cent.	*Per cent.*		
5 gm	3.06	5.[illegible]0	1[illegible].0	32.5
4 gm	4.02		[illegible].3	
3 gm	[illegible].31		29.4	
2 gm	7.04	7.[illegible]1	39.0	46.6
1 gm	10.34	9.41	57.3	57.5

Using the constants for the variations in the percentage solubility with different amounts of the sample, results were calculated which agreed very closely with those obtained in the actual analysis. It will be observed that the differences in the percentage solubility of the reverted phosphoric acid in the 2 samples disappeared when 1 gm. of substance was used.

[1] Ztschr. analyt. Chem., 1893, p. 257.

Apatite (containing 39.55 per cent of phosphoric acid), superphosphate (6.91 per cent of total and 5.50 per cent water-soluble phosphoric acid), and a basic phosphate, obtained by supersaturating a sodium phosphate solution with calcium chlorid, were treated with 100 cc. of tri-ammonium citrate solution. The basic phosphate was found to contain 37.41 per cent of phosphoric acid and 48.11 per cent of calcium oxid, corresponding to the formula $13CaO \cdot 4P_2O_5$. The following results were obtained:

Citrate solubility of phosphoric acid in different phosphates.

Weight taken.	Citrate-soluble phosphoric acid			Percentage solubility.		
	Apatite	Superphosphate	Basic phosphate	Apatite	Superphosphate.	Basic phosphate.
	Per cent	*Per cent*	*Per cent.*			
5 gm	1.05	6.04	11.97	2.7	87.4	32.0
2 gm	1.57	.....		4.0	.....	.....
1 gm	1.86	6.40	28.54	4.7	92.6	76.3

If the water-soluble phosphoric acid in the superphosphate be subtracted from the percentages given, the figures for 5 and 1 gm. will be changed to 38.3 and 64 per cent, respectively.

A citrate solution made up according to Wagner's directions[1] was used in treating one sample each of the bone meal and Thomas slag, with the following results:

Solubility of phosphoric acid in Wagner's citrate solution.

Substance weighed out.	Citrate-soluble phosphoric acid		Percentage solubility.	
	Bone meal	Thomas slag.	Bone meal	Thomas slag
	Per cent	*Per cent*		
2.5 gm	18.92	8.79	61.7	53.8
1.0 gm	24.56	9.15	80.1	56.0
2.5 gm	19.33	9.20	63.1	56.3
1.0 gm	25.89	9.57	84.5	58.6

The temperature of the room was about 4° higher when the last two tests were made, which possibly explains the higher results obtained. The solubility found for Thomas slag is seen to vary but little with different amounts of substance weighed out, compared with the data obtained for bone meal.

The author claims that the solubility of the different kinds of phosphates in citrate solution can not be considered indicative of their comparative agricultural value. He recommends the general adoption of Wagner's citrate solution, the digestion to take place always at the same temperature.[2]—F. W. WOLL.

[1] Chem. Ztg., 18, p. 1935.

[2] Wagner, Chem. Ztg., 19, p. 1420, recommends 17.5° C.

The variation in the composition of superphosphates and the evolution of hydrofluoric-acid gas in superphosphates made from phosphorites (*Rpt. Agl. Chem. Soc. Bologna, 23 (1894–'95), pp. 23–25*).—Determinations at different dates from September 22, 1894, to June 15, 1895, of soluble and reverted phosphoric acid in 3 samples of superphosphates made from mineral phosphates, showed a regular and marked increase of soluble phosphoric acid, while with superphosphates made from bone no such increase was observed. Further investigation showed that this increase was due to the gradual evolution of hydrofluoric-acid gas in case of the superphosphate made from the mineral phosphates.

The determination of the milk sugar content of milk, as well as the specific gravity of the milk serum: A contribution to milk analysis, E. VON RAUMER and E. SPÄTH (*Ztschr. angew. Chem., 1896, Nos. 2, pp. 16–19; 3, pp. 70–73*).—Seventy-four analyses of fresh milk are given. After long experience the authors give the following as the simplest method found for the preparation of the milk serum: A beaker weighing with glass rod about 60 gm. is partly filled with from 200 to 260 cc. of milk, and weighed on a balance sensible to 5 mg.; 2 cc. of 20 per cent acetic acid is added and the whole heated on a water bath for a half hour. After cooling, water is added to the original weight and the whole stirred and filtered. The first drops are apt to be turbid and should be refiltered. If the filtrate is still turbid, alumina cream is added to a weighed portion and the whole heated and then brought to weight again. This gives a clear serum. The specific gravity is then determined with a 50 cc. picnometer, which the authors deem the only way in which results absolutely correct to the fourth decimal can be obtained.

For the determination of milk sugar 25 cc. of milk is well shaken in a half liter flask with 400 cc. of water, 10 cc. of Fehling's solution (without the Rochelle salt), and 3.9 to 4.2 cc. normal potassium hydroxid, the liquid filled to the mark with water and filtered. The filtrate should contain an excess of copper sulphate, and accordingly should not react alkaline. The sugar is determined gravimetrically in 100 cc. portions of the filtrate by the Soxhlet Allihn method. If the milk serum is used the same procedure is followed, but the results are uniformly 0.1 to 2 per cent higher than those obtained with the milk. The milk sugar in curdled milk is determined in the serum.

Analyses are also given which show that the specific gravity of the serum decreases on standing, most noticeably after the first 24 hours. The content of milk sugar also falls off rapidly and especially at a slightly raised temperature. Both the specific gravity and the sugar content can, however, be determined with fair accuracy during the first 24 hours. The authors believe these determinations to be of especial value in detecting watered milk.

Experiments on polarization go to show that if the milk is polarized

without previous heating too low results are obtained, while if basic lead acetate is present during the heating much of the sugar is actually destroyed. The following method gave excellent results where it could be used: Fifty cubic centimeters of milk was heated to boiling in a 100 cc. measuring flask, cooled to 17.5°, and 10 cc. of basic lead acetate added. The whole was then made to 100 cc., filtered, and polarized in a 200 mm. tube. If the serum, obtained as above, was used 100 cc. was taken and directly cleared with basic lead acetate, filtered, and polarized in a 220 mm. tube. In many cases the results compared closely with those obtained by the gravimetric method. However, the polarimetric method, while it results in a great saving of time, in many cases gives too high results. The authors give results to show that this can not be due to any reagents used, but attribute it to the occurrence in some milk of a dextrin-like body which does not reduce Fehling's solution but which gives greater rotation to the right. Ritthausen, Schmoeger, and Landwehr have also proved the presence of such carbohydrates in milk. These carbohydrates may vary very much in quantity, and appear to be present especially in the colostrum.

The following conclusions are drawn: The specific gravity of a normal milk serum varies between 1.0260 and 1.0330. The content of milk sugar varies between 4.25 and 5.20 per cent if determined in the milk direct, but is from 0.1 to 0.2 per cent higher in the serum. An addition of water can only be proved in a curdled milk when results on the original fresh milk are at hand for comparison, and then only within 24 hours. The determination of milk sugar by polarization is not allowable on account of the occurrence in certain milk of dextrin-like bodies which affect polarized light but do not reduce copper solution.—C. L. PARSONS.

Cold saponification: Saponification and Reichert-Meissl numbers, R. HENRIQUES (*Ztschr. angew. Chem., 1895, No. 24, pp. 721–724*).—After comparing cold and warm saponification on several oils, such as linseed, cotton-seed, olive, cocoanut, etc., to the advantage of the former, the author states that he considers cold saponification especially to be recommended in the determination of the Reichert-Meissl number of fats and oils. By the old methods ethers of the volatile fatty acids are formed, but this can be entirely avoided by cold saponification. The results obtained are also several tenths higher.

Five grams of the fat is dissolved in a porcelain dish in 25 cc. of petroleum ether, 25 cc. of a 4 per cent solution of sodium hydroxid added, and the whole allowed to stand overnight. Saponification is complete in the morning. The whole is then evaporated to complete dryness on a water bath. The residue is transferred to a flask and distilled as usual. The results are some 0.5 cc. higher than by the usual method of Wollny.—C. L. PARSONS.

The determination of pentoses and pentosans by distillation with hydrochloric acid, MANN, KRÜGER, and TOLLENS (*Ztschr. angew. Chem., 1896, No. 2, p. 33*).—The authors have carefully studied the

methods of determining the pentoses by distillation with hydrochloric acid, and find the former factors not absolutely correct. They give the following factors:

Hydrazone	× 0.5160 + 0.0104	furfurol.
Do.	× 0.9865	xylose.
Do.	× 1.2126 —	arabinose.
Do.	× 1.0995	pentose.
Do.	× 0.8681	xylan.
Do.	× 1.0671	araban.
Do.	× 0.9676	pentosan.

It was found that the results obtained by the phloroglucin method proposed by Councler[1] are as reliable as those obtained by the phenylhydrazin method. The phloroglucin method is carried out as follows: Two to five grams of the substance is distilled with 100 cc. hydrochloric acid of 1.06 sp. gr. (12 per cent HCl) exactly as prescribed by Flint and Tollens.[2] To the distillate twice as much phloroglucin, previously dissolved in a little hydrochloric acid, 1.06 sp. gr., is added as there is furfurol assumed to be present. The volume is made up to 400 cc. with acid of the same strength, the solution well stirred and allowed to stand overnight. The precipitate is then collected on a tared filter, washed with 150 cc. of water, dried, and weighed. The following factors are used:

Factors for calculating furfurol

Phloroglucid obtained	Divisor for calculating furfurol	Phloroglucid obtained	Divisor for calculating furfurol
0.2	1.820	0.34	1.911
0.22	1.839	0.36	1.916
0.24	1.856	0.38	1.919
0.26	1.871	0.40	1.920
0.28	1.884	0.45	1.927
0.30	1.895	0.50	1.930
0.32	1.904	0.60 etc.	1.930

(Furfurol — 0.0104)	× 1.68	xylan.
Do.	× 2.07	araban.
Do.	× 1.88 -	pentosan.
Do	× 1.91	xylose.
Do.	× 2.35	arabinose.
Do.	× 2.13	pentose

The formation of furfurol during the distillation of certain substances which are known not to contain pentosans is supposed to be due to the presence of hitherto unknown bodies which are probably formed by the oxidation of starch and which are easily decomposed.—W. H. KRUG.

The determination of pentoses and pentosans by distillation with hydrochloric acid, B. TOLLENS (*Ztschr. angew. Chem., 1896, No. 7, p. 194*).—The author has decided that the factors given in his last

[1] Chem. Ztg., 1894, No. 51.
[2] Landw. Vers. Stat., 42, p. 381.

paper on this subject[1] are too complicated, and proposes to return to the simple factor 1.84, previously published by him and Mann. The factors now given are:

Furfurol	× 1.84 -	pentosan.
Do.	× 1.64	xylan.
Do.	× 2.02	araban.

—W. H. KRUG.

On the detection of pentoses by the phloroglucin-hydrochloric acid precipitate method, B. TOLLENS (*Ber. deut. chem. Ges., 29 (1896), No. 8, pp. 1202–1209*).—As is well known, pentoses and pentosans may be detected by warming the solution with an equal volume of hydrochloric acid and a little phloroglucin; the mixture will assume a cherry-red color, giving a characteristic absorption band in the spectrum between the lines D and E. The solution quickly becomes turbid from the separation of a dark deposit which soon renders the recognition of the absorption band impossible, and the difficulties in applying the test to impure solutions, such as plant juices, urine, etc., are very considerable. If, however, the brown deposit produced in the reaction be dissolved in alcohol the characteristic color and spectrum band are reproduced. The author's method consists in filtering and washing the dark deposit and dissolving it on the filter in alcohol. A colored solution is produced that is sufficiently permanent to be examined satisfactorily with the spectroscope. The author has tried this method with various sugars and upon several natural products and finds it much more certain and considerably more delicate than the direct application of the test.—A. M. PETER.

The composition of wood gum, S. W. JOHNSON (*Jour. Amer. Chem. Soc., 18 (1896), No. 3, p. 214*).—The gum of corncobs was found to consist almost wholly of xylan, but birchwood gum on hydrolysis yields a sirup which gives only a very small amount of crystals on long standing or fractionating with alcohol. "Seeding" with crystals of xylose does not increase the yield. Vegetable ivory, when extracted with sodium hydroxid solution, yields a large amount of mannan, which is easily obtained pure. It is probably accompanied by an alkali-soluble substance of lower carbon content. All these substances are difficult to obtain on account of their hygroscopic nature. They are most easily dried in vacuo at 110 to 112°.—W. H. KRUG.

On the ammonia derivatives of some sugars, C. A. LOBRY DE BRUYN and F. H. VAN LEENT (*Neue Ztschr. Rübenz. Ind., 36 (1896), No. 7, p. 78; Rec. trav. Chim. Pays-Bas, 12, p. 286; 14, p. 98*).—Dry ammonia gas has no action on lactose or its anhydrids at normal temperatures. In a concentrated aqueous solution of ammonia the normal rotation of $[a]_D = +53°$ falls to $[a]_D = +30°$ in 5 days. Lactose hydrate dissolves quite readily in methyl alcohol containing about 20 per cent of ammonia. This solution within 11 to 18 days deposits

[1] Ztschr. angew. Chem., 1896, No. 2, p. 33.

crystals, which are an addition product of lactose and ammonia, $C_{12}H_{22}O_{11} \cdot NH_3$. It decomposes when exposed to the air, giving off ammonia.—W. H. KRUG.

The inversion of sugar by salts, J. H. LONG (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, p. 120*).—The author studied the influence of FeI_2, $FeCl_2$, $FeBr_2$, $FeSO_4$, $FeSO_4(NH_4)_2SO_4$, $MnCl_2$, $MnSO_4$, $ZnSO_4$, $KAlS_2O_3$, $Pb(NO_3)_2$, $PbCl_2$, $CdCl_2$, and $HgCl_2$ on the rotation of sucrose solutions. It was found that in every case the dextrorotation was eventually changed to levorotation. Exact experiments made with FeI_2 showed that the inversion proceeds in accordance with the law of Wilhelmy-Ostwald. The cause of the inversion is no doubt to be sought in the partial hydrolytic decomposition of the salts, as they consist of a strong acid ion and a weak basic ion.—W. H. KRUG.

The action of diastase on starch, PETIT (*Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 15, p. 132; abs. in Chem. Centbl., 1896, I, No. 11, p. 588*).—The malt infusion was allowed to act on starch in the cold at a constant temperature until the iodin reaction disappeared. Further formation of sugar was prevented by adding salicylic acid. If y represents the amount of maltose formed per 100 gm. starch and x the temperature, then the following equations represent the reaction:

$$y = b \sin (a - x) - ma (a - x), \ x \text{ being from } 18\text{–}56$$
$$x = a' \sin (c - y) - mb (c - y), \ x \text{ being from } 56\text{–}75$$

The maximum amount of maltose was formed at 47°. The rotatory power (referred to 1 gm. dextrin in 100 cc.) is least at 47° and highest at 67 to 68°, a point when the maltose content rapidly decreases.—W. H. KRUG.

The natural oxycelluloses, C. F. CROSS, E. J. BEVAN, and C. BEADLE (*Jour. Amer. Chem. Soc., 18 (1896), No. 1, pp. 8–21*).—The investigation related to the distribution of the furfuroids, *i. e.*, the substances forming furfuran, in the permanent tissue which resists the action of alcohol, dilute sodium hydrate solution, and dilute hydrochloric acid, and in the cell contents of barley. The permanent tissue contains over 90 per cent of the total furfuroids during the first growth of the plant and at the time of harvesting. The composition of the permanent tissue is constant and independent of the varying conditions of growth. The straw of the ripe plant gives 12 to 15 per cent of furfurol both before and after treatment with 2 to 3 per cent hot sodium-hydrate solution, and this seems to show that the composition of the assimilated material is only dependent on the composition of the assimilating substance, and not on exterior influences.

Bleached straw cellulose is completely soluble in sulphuric acid, sp. gr. 1.62. When this solution is poured into water a cellulose hydrate separates which yields almost no furfurol. The soluble products can be separated into a fraction which gives an insoluble compound with barium carbonate, and one which is not precipitated by this reagent.

The soluble products gave 46.6 per cent of their weight in furfurol, and reduced 30.6 per cent of the amount of copper oxid reduced by an equal amount of dextrose. This reducing power was increased to 68.3 per cent by boiling the sulphuric-acid solution. Oxidation of the soluble products by potassium permanganate or by Fehling's solution gave large quantities of acetic acid.

The composition of the straw of wheat and barley is calculated to be approximately: 33 per cent lignocellulose with 25 per cent cellulose and 2.6 per cent furfurol, 25 per cent cellulose resisting chlorin, 21 per cent hemicellulose, and 21 per cent pentosans.—W. H. KRUG.

The law of the decomposition of salts by water, GUICHARD (*Bul. Soc. Chim. Paris, ser. 3, 15-16 (1896), No. 9, pp. 555-560*).

The fusibility of platinum in the carbon blast oven, V. MEYER (*Ber. deut. chem. Ges., 29 (1896), No. 6, pp. 850-852, fig. 1*).—Pure platinum and platinum (75 per cent) and iridium (25 per cent) alloy were lightly inclosed in a fire-clay retort and heated in a graphite blast oven. When the retort was cooled and opened the platinum was melted, the alloy unaltered.

On the formation of soda in nature, S. TANATAR (*Ber. deut. chem. Ges., 29 (1896), No. 7, pp. 1034-1038*).

On a basic nitrate of magnesium, G. DIDIER (*Compt. Rend., 122 (1896), No. 17, pp. 935, 936*).

On a crystalline sesquiphosphate of iron, A. GRANGES (*Compt. Rend., 122 (1896), No. 17, pp. 936, 937*).

On the catalytic action of nitrous acids and the potential of nitric acid, R. IHLE (*Ztschr. physikal. Chem., 19 (1896), No. 1, pp. 577-591, figs. 2*).

On the formation of ammonia by the electrolysis of nitric acid, R. IHLE (*Ztschr. physikal. Chem., 19 (1896), No. 1, pp. 572-576*).

The biochemical preparation of sorbose, G. BERTRAND (*Compt. Rend., 122 (1896), No. 16, pp. 900-903*).

Galactite from the seed of yellow lupines, H. RITTHAUSEN (*Ber. deut. chem. Ges., 29 (1896), No. 6, pp. 896-899, fig. 1*).

The detection and determination of small amounts of magnesia in limestone, A. HERZFELD and A. FÖRSTER (*Ztschr. Ver. Rübenz. Ind., 1896, Apr., pp. 284-288*).

The action of some animal secretions and organs on the polysaccharids. E. FISCHER and W. NIEBEL (*Sitzungsber. kgl. Akad. Wissensch.;* abs. in Chem. Centbl., 1896, I, No. 9, p. 499*).

Crystallized δ-mannose, W. A. VAN ECKENSTEIN (*Rec. trav. Chim. Pays-Bas, 14, p. 329; abs. in Chem. Centbl., 1896, I, No. 13, p. 693*).—The author found δ-mannose in the form of crystals. It has hitherto been known only as a sirup. Its solution shows multirotation, being at first levorotatory, but finally becoming dextrorotatory.—W. H. KRUG.

Crystallized anhydrous rhamnose, E. FISCHER (*Ber. deut. chem. Ges., 29 (1896), No. 3, p. 324*).

The digestion of trehalose, E. BOURQUELOT and E. GLEY (*Compt. rend. Soc. Biol., 1895, p. 555; Centbl. Physiol., 9, p. 787; abs. in Chem. Centbl., 1896, I, No. 18, p. 970*).

The chemical composition of Austro-Hungarian sugars, F. STROHMER and A. STIFT (*Ztschr. Nahr. Untersuch. und Hyg. Waarenk., 10 (1896), No. 2, p. 33*).

Test for mineral acid in vinegar, NICKEL (*Pharm. Ztg.; Pharm. Centbl., 35, p. 85; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No 4, p. 604*).—Add a considerable quantity of phloroglucin to the vinegar, insert a splinter of pine or bamboo, and boil until the phloroglucin is dissolved. If mineral acid is present, a decided coloration will be observed.

The compounds of the sugar ethylene, trimethylene, and benzyl-mercaptan,

W. T. LAWRENCE (*Ber. deut. chem. Ges., 29 (1896), No. 4, p. 547; abs. in Chem. Ztg., 20 (1896), No 30, Repert., p. 96*).

Analytical methods for sugar beets, KUHNKE (*Deut. Zuckerind., 21 (1896), p. 65*).

Two reactions for distinguishing lactose from glucose, L. RUIZARD (*Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 13, p. 665; abs. in Ber. deut. chem. Ges., 29 (1896), No. 3, Ref., p. 147*).

Papain as a digestive agent, D. B. DOTT (*Pharm. Jour., 1896, No. 1341, p. 182*).

Candy adulteration, KABRHEL and STRAND (*Arch. Hyg., 25 (1896), No. 4, p. 321; abs. in Chem. Ztg., 20 (1896), No. 30, Repert., p. 101*).—The authors found barium sulphate, chromium compounds, and ultramarine. In some cases traces of iron and manganese were discovered. They point out the importance of examining the portion of the ash which is insoluble in hydrochloric acid and which consists mostly of barium sulphate.—W. H. KRUG.

Note on commercial litmus, D. R. BROWN (*Pharm. Jour., 1896, No. 1341, p. 181*).

The use of acetylene as a source of light for polarimetric readings, H. W. WILEY (*Jour. Amer. Chem. Soc., 18 (1896), No. 2, p. 179*).—The author finds that the acetylene light is peculiarly well adapted to the reading of highly-colored solutions.—W. H. KRUG.

A modified polariscope for chemical purposes, H. LANDOLT (*Neue Ztschr. Rübenz. Ind., 36 (1896), No. 8, p. 87*).

Berthelot's contributions to the history of chemistry, H. C. BOLTON (*Chem. News, 73 (1896), No. 1902, pp. 214–216*).

Analytical chemistry, N. MENSCHUTKIN (*Trans. from third German edition by J. Locke. London: Macmillan & Co., 1895, pp. XII, 512; reviewed in Nature, 54 (1896), May 7, pp. 6, 7*).

Chemical division of Kentucky Station, A. M. PETER (*Kentucky Sta. Rpt. 1894, pp. XI–XIX*).—Analyses are given of sorghum cane juice (see p. 862), butter, soils, wood ashes, ash of clover hay and corn stover, tobacco stems, vivianite, limestone, and mineral waters.

Miscellaneous analyses, L. H. MERRILL (*Maine Sta. Rpt. 1894, pp. 13–15*).—Analyses are given of hay, corn silage, corn meal, cotton-seed meal, and corn-and-cob meal fed in connection with a digestion experiment; analyses of the feces of sheep used in digestion experiments, of 5 samples of Paris green, and of wood ashes, marl, and soil.

BOTANY.

Hypostomaceæ, a new family of parasitic fungi, P. VUILLEMIN (*Compt. Rend., 122 (1896), No. 9, pp. 545–548*).—Two new genera of the order Ustilagineæ are described, which the author considers as constituting a new family of that order. They resemble in some respects the Ascomycetes and the Hyphomycetes. Both are parasitic on the leaves of conifers. The first, to which the name *Meria laricis* is given, is said to be the cause of the larch disease recently described by E. Mer.[1] The second fungus is called *Hypostomum flichianum*, and it was found parasitic on the leaves of *Pinus austriaca* and *P. montana*. Technical descriptions are given of both species, together with brief notes upon their affinities.

On the selection of organic food materials by plants, W. PFEFFER (*Pringsheim's Jahrb. wiss. Bot., 28 (1895), pp. 205–268; abs. in Bot. Gaz., 21 (1896), No. 3, pp. 161–163*).—A study was made of the

[1] Compt. Rend., 121 (1895), No. 25, p. 964.

selective power of plants in taking up organic food by offering 2 carbon containing compounds, each of which was present in sufficient quantity to fully supply the demands of the plant. Most of the experiments were conducted with *Aspergillus niger* and *Penicillium glaucum*. In one case where dextrose and glycerin were added to the nutrient medium both were used, but the dextrose was drawn upon to a much greater extent. In case dextrose was present in small quantity it was totally consumed before the glycerin was attacked. When lactic acid was substituted for glycerin, results similar to the above were obtained. In case acetic acid was offered with dextrose, although apparently a poorer food, it was consumed in a greater amount in proportion to the quantity offered than the dextrose. The explanation for this is its possible greater adaptability for certain functions of the plant.

When peptones took the place of dextrose, results similar to the above took place. By growing several fungi in dextro and levorotatory tartaric acids it was found that many of them attacked the dextro acid, some, apparently, made no distinction, and one attacked the levo acid, leaving it dextrorotatory. The causes influencing selection are thought to be functions of irritability. In cases of widely different osmotic properties, the material penetrating more rapidly, whether the better food or not, will supply the demand to the greater degree. The stimuli prompting a choice arise either from the plant's products or from the substance offered.

The author has introduced the term "economic coëfficient" to express the dry content of the plant produced by the consumption of 100 parts of the food material. For the 2 fungi most extensively experimented with the economic coëfficients are: For *Aspergillus niger*, dextrose 43, glycerin 20; for *Penicillium glaucum*, dextrose 33, and glycerin 15.

On the influence of an abundant nitrogen supply upon the assimilation and respiration of plants, H. MÜLLER THURGAU (*Centbl. agr. Chem., 21 (1895), p. 451; abs. in Naturw. Rundschau, 11 (1896), No. 5, p. 62*).—The influence of abundant supply of nitrogen upon the assimilation and respiration of plants was tested by the author with potatoes and sugar beets grown in plats of equal fertility. To one of the plats Chile saltpeter was added from time to time. The plants grown in the plat containing abundant nitrogen were more vigorous and of a darker green color. The chlorophyll content of the potatoes was as 260 to 100; there was also a more abundant production of flowers and a greater yield of tubers. The weight of the harvested tubers was greatly increased, while their sugar and starch content was smaller for the plats receiving additional nitrogen. The smaller sugar and starch content is attributed to the greater vegetative activity of the plants and a consequent greater demand on these substances for growth. Young tubers gave off per kilogram at 20° C. in 10 hours 9.47 gm. car-

bon dioxid where nitrogen was abundant, as compared with 0.38 gm. where it was deficient. The roots also showed great differences in their respiration. Experiments with sugar beets gave results similar to those with potatoes. In summarizing the results of his investigations, the author shows that an abundant nitrogen supply produces the following effects: There is an increased leaf area and an increased chlorophyll content, a deficiency in the starch formation in the leaves and a rapid using up of the starch present, a reduced content of reserve material, a higher glucose content, a quicker solution of reserve stuff, an increase in the content of combined nitrogen, a higher respiration in all the parts as well as a higher nitrogen content, and an increased growth in all the parts.

Experiments on the nitrogen feeding of green plants, T. BOKORNY (*Chem. Ztg., 20 (1896), No. 7, p. 53*).—The author conducted a series of investigations with Spirogyra to see whether it could obtain its nitrogen from the following compounds: Glycocol, urethan, ethylamin, trimethylamin, cyanuric acid, and sulphocyanate of potash. These substances were chosen, as they represent different groups of organic nitrogenous compounds. The plants were grown in 0.1 per cent solutions, the cyanuric acid being neutralized with limewater and the ethylamin and trimethylamin with sulphuric acid. After allowing the plants to remain in the solutions for a considerable time, they were tested with caffein for active albumen. Of the 6 substances tested, only the first 2 were found available as nitrogen sources for the plants.

On the origin of honeydew, G. BONNIER (*Rev. gén. Bot., 8 (1896), No. 85, pp. 5-22; abs. in Gard. Chron., ser. 3, 19 (1896), No. 181, p. 129*).—The conclusions of the author from his investigations on honeydew and its production are as follows:

"Although the aphis and scale insect are the chief causes of honeydews, yet they may be produced by the plants under certain conditions. The direct production may be observed microscopically, the small drops being exuded through the stomata.

"The production of honeydew by aphis is maintained throughout the day, diminishing at night, while that produced by the plant usually ceases during the day, the maximum production taking place about daybreak.

"Cool nights and dry hot days are favorable for the production of vegetable honeydew as well as an increase in moisture and darkness, the other conditions being equal.

"The exudation of sweet solutions through the stomata may be produced by plunging branches into water and placing them in darkness.

"It is well known that bees will take any sweetened substance offered them if no other supply is available, yet wherever possible they will choose the source offering the best, and when plants are flowering abundantly they will forsake the honeydew, especially that formed by the aphides, for the nectar of the flowers. On the contrary, if there is a lack of nectar, they will collect honeydew.

"The chemical composition of the different honeydews from different plants is very variable, and that produced by the plant approaches more nearly the composition of the nectar of flowers than that by insects."

Some native ornamental grasses, II, T. H. KEARNEY (*Garden and Forest, 9 (1896), No. 427, pp. 172, 173*).

New or noteworthy grasses, IV, G. V. NASH (*Torrey Bul., 23 (1896), No. 4, pp. 147–151*).—Critical notes and descriptions of new species of grasses are given.

Grass notes, F. LAMSON-SCRIBNER (*Torrey Bul., 23 (1896), No. 4, pp. 141–147, pl. 1, figs. 2*).—Critical notes and descriptions of new species are given.

Notes on some species of Meliola, F. S. EARLE (*Bot. Gaz., 21 (1896), No. 4, pp. 224–228*).

New species of Kansas fungi, J. B. ELLIS and E. BARTHOLOMEW (*Erythea, 4 (1896), No. 5, pp. 79–83*).—The following new species are described: *Polyporus cryptopus, Puccinia clavispora, P. tecta, Phoma biformis, Cytispora celastrina, C. gleditschiæ, Spheropsis robiniæ, S. triacanthi, Haplosporella longipes, H. negundinis, Diplodia inquinans, Cercosporella nivea, Coniosporium maydis, Dendryphium curtipes*, and *Cladosporium subsessile*.

New species of fungi from Mississippi, S. M. TRACY and F. S. EARLE (*Torrey Bul., 23 (1896), No. 5, pp. 205–211*).—Twenty-two new species of fungi are described.

Two new fungi from Germany, G. LINDAU (*Hedwigia, 35 (1896), No. 2, pp. 56, 57, fig. 1*).—*Chætomium marchicum* and *Peziza alpigena* are described as new species.

Schroeteriaster, a new genus of Uredineæ, P. MAGNUS (*Ber. deut. bot. Ges., 14 (1896), No. 3, pp. 129–133, pl. 1*).—This new genus is founded upon *Uromyces alpinus*.

Hints on the study of fungi, E. F. SMITH (*Asa Gray Bul., 4 (1896), Nos. 3, pp. 25–28; 4, pp. 37–43.*)

Brazilian plants which contain mannite, T. PECKOLT (*Ztschr. allg. österr. Apoth.-Ver., 34 (1896), p. 227; abs. in Chem. Ztg., 20 (1896), No. 30, Repert., p. 104*).—*Genipa americana*, a tree which grows throughout South America south of the equator, contains mannite. The fresh leaves gave 0.51 per cent, the bark 0.79 per cent. Mannite was also found in *Basanacantha spinosa ferox*, the leaves containing 1.93 per cent and the bark 0.60 per cent.—W. H. KRUG.

On the polymorphism of Populus tremula and its variety freyni, J. HERVIER (*Rev. gén. Bot., 8 (1896), No. 89, pp. 177–187, pl. 1*).

Contributions to the biology of geophilous plants, F. W. C. ARESCHONG (*Acta Reg. Soc. Phys. Lund., 6 (1896), pp. 60, figs. 28; abs. in Bot. Ztg., 54 (1896), II, No. 8, pp. 124–126*).

On the localization of the active principles of some plants, L. SAUVAN (*Jour. Bot. France, 10 (1896), Nos. 7, pp. 126–132; 8, pp. 133–140; 9, pp. 157–162*).

On some protein crystalloids and their probable relation to the nutrition of the pollen tube, L. H. HUIE (*Internat. Jour. Micr. and Nat. Sci., ser. 3, 6 (1896), No. 30, pp. 113–121, pl. 1*).

On the biology of pollen, B. LIDFORSS (*Pringsheim's Jahrb. wiss. Bot., 29 (1896), No. 1, pp. 1–38*).

Concerning the perithecia of the Erysipheæ, P. VUILLEMIN (*Rev. Mycol., 18 (1896), No. 70, pp. 61, 62, pl. 1*).

Contributions to the morphology and systematic botany of Myxomycetes, C. SCHILBERSKY (*Bot. Centbl., 66 (1896), No. 3, pp. 81–85, pl. 1*).

Concerning the conditions for conidia formation by rust fungi, W. SCHOSTAKOWITSCH (*Flora, 81 (1895), p. 362; abs. in Centbl. Bakt. und Par. Allg., 2 (1896), No. 6–7, pp. 235–237*).

The probable influence of disturbed nutrition on the evolution of the vegetative phase of the sporophyte, G. F. ATKINSON (*Amer. Nat., 30 (1896), No. 353, pp. 349–357*).

On the action of certain alkaloids upon plants in darkness and in the light, A. MARCACCI (*Nuovo Giorn. Bot. Ital., 1895, pp. 222–227; abs. in Bot. Centbl., 66 (1896), No. 5–6, p. 193*).

On the action of light and other external agents upon the liberation of perfume, E. MESNARD (*Rev. gén. Bot., 8 (1896), Nos. 88, pp. 129–157; 89, pp. 203–216, figs. 13*).

Contributions to the chemistry of chlorophyll, VII, E. SCHUNCK and L. MARCHLEWSKI (*Proc. Roy. Soc., 59 (1896), No. 355, pp. 233–235, fig. 1*).

Physiology of color in plants, D. T. MACDOUGAL (*Pop. Sci. Monthly, 49 (1896), No. 1, pp. 71–80, figs. 4*).

On the origin of chromatic and achromatic substances in plant and animal cells, M. LAUDOWSKY (*Anat. Hefte, 4, pp. 355–446, pls. 6; abs. in Bot. Centbl., 66 (1896), No. 3, pp. 91, 92*).—The methods for fixing are given in considerable detail.

Concerning centrosomes and central spindles, R. HERTWIG (*Sitzungsber. Ges. Morph. und Physiol. München, 1895, pp. 41–59; abs. in Bot. Centbl., 66 (1896), No. 3, p. 93*).

The trichomes of conifers, C. VON TUBEUF (*Forstl. naturw. Ztschr., 5 (1896), Nos. 3, pp. 109–124, pls. 12; 5, pp. 173–193, pls. 3*).

Notes on the carbon and nitrogen nutrition of fungi, T. BOKORNY (*Chem. Ztg., 20 (1896), No. 9, p. 69*).—Original observations and compiled notes are given on the value of a number of compounds as sources of carbon and nitrogen for fungi.

Researches on the division of the nucleus in plants, C. DEGAGNY (*Bul. Soc. Bot. France, ser. 3, 43 (1895), Nos. 1, pp. 12–21; 2, pp. 51–59*).

Concerning the effect of carbon dioxid on the protoplasm of living plant cells, G. LOPRIORE (*Pringsheim's Jahrb. wiss. Bot., 28 (1895), pp. 531–626, pls. 2, figs. 3; abs. in Bot. Ztg., 54 (1896), II, No. 9, pp. 132–135*).—The author found that atmospheres containing large amounts of carbon dioxid were injurious to the protoplasm of the hairs on the stamens of Tradescantia, stopping the streaming of the protoplasm. It also checked or prevented the germination of Mucor spores as well as the development of the pollen tubes of some phanerogams.

The disorganization phenomena of cells, P. KLEMM (*Pringsheim's Jahrb. wiss. Bot., 28 (1895), No. 4; abs. in Bot. Ztg., 54 (1896), II, No. 9, pp. 135, 136*).

Decomposition of albuminoid matters during germination, D. N. PRIANISCHNIKOW (*Ann. Agl. Inst. Moscow, 1 (1895), No. 1–2, pp. 175–205*).

Healing of incisions in vegetable tissues, S. G. SHATTOCK (*Gard. Chron., ser. 3, 19 (1896), No. 491, p. 618*).

An experiment with Röntgen rays on germinating plants, A. SCHROBER (*Ber. deut. bot. Ges., 14 (1896), No. 3, pp. 108–110*).

Mycological contributions, E. ROSTRUP (*Bot. Tidsskr., 20 (1896), No. 2, pp. 137–139*).—A French resumé is given of a preceding Danish article, in which *Sorosporium montiæ, Entomophthora aphrophora*, and *Spegazzinia ammophila* are described as new, and critical notes given on numerous other fungi.

The interdependence of plants and animals, J. RODNEY (*Gard. Chron., ser. 3, 19 (1896), No. 487, pp. 517, 518*).

Flowers and insects, XVI, C. ROBERTSON (*Bot. Gaz., 21 (1896), No. 5, pp. 266–274*).—Notes are given on the relations between some liliaceous plants and their insect visitors.

Experimental researches on how flowers attract insects, F. PLATEAU (*Bul. Roy. Acad. Sci. Belge, ser. 5, 30 (1895), No. 11, pp. 466–488; abs. in Bot. Ztg., 54 (1896), II, No. 8, pp. 123, 124*).

The flora of West Virginia, C. F. MILLSPAUGH and L. W. NUTTALL (*Field Columbian Museum, Bot. Ser., 1 (1896), No. 2, pp. 1–276, pls. 3*).

Distribution of Rhamnus in America, I, E. L. GREENE (*Erythea, 4 (1896), No. 6, pp. 83–86*).

Useful Australian plants, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 3, pp. 127–131, pls. 2*).—On bloodwood (*Eucalyptus corymbosa*) and the small bur grass (*Lappago racemosa*).

The flora of British India, XXI (*London: 1896, pp. 224*).—In the present part some of the Gramineæ are described by Sir J. D. Hooker.

The Japanese deciduous trees in winter condition, H. SHIRASAWA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 5, pp. 229–300, pls. 13*).—By means of illustrations and descriptions of bark, buds, lenticels, spines, etc., the author has furnished a key to the deciduous trees and shrubs of Japan, about 260 species and varieties being described.

A new microchemical reagent for chlorophyll, H. MOLISCH (*Ber. deut. bot. Ges., 14 (1896), No. 1, pp. 16–18*).

A simple freezing device, W. J. V. OSTERHOUT (*Bot. Gaz., 21 (1896), No. 4, pp. 195–201, figs. 6*).

A compendium of general botany, M. WESTERMAIER (*Trans. by A. Schneider. New York: John Wiley & Son, 1896, pp. X, 299, figs. 171*).

ZOÖLOGY.

The common crow of the United States, W. B. BARROWS and E. A. SCHWARZ (*U. S. Dept. Agr., Division of Ornithology and Mammalogy Bul. 6, pp. 98, pl. 1, figs. 2*).

Synopsis.—This bulletin consists of an elaborate report on a study of the food habits of the common crow, and comprises chapters on general habits, the animal food, insect food, vegetable food, and the protection of crops. The contents of 909 stomachs were examined, and found to average about 33 per cent of animal, 57 per cent of vegetable, and 10 per cent of mineral matter. The insect food was about 24 per cent, and consisted mainly of injurious insects. The remaining animal food was mainly offal, small mammals, and frogs. The corn eaten was about 25 per cent of the whole food, but chiefly waste grain. The conclusion is that the crow is more beneficial than injurious.

General habits (pp. 9–25).—Brief mention is made of the geographical distribution of the common crow (*Corvus americanus*), which is found throughout the United States, though rare in the arid regions of the West. It is stated that crows are migratory to some extent, though the latitude gone over is usually not great. Extensive descriptions are given of the winter roosts of crows, where individuals collect at night often to the number of many thousands, flying in the day several miles for feeding purposes. The chief roosts, in each of which from 100,000 to 200,000 crows collect, are in New Jersey, Pennsylvania, Maryland, District of Columbia (Arlington, Virginia), Indiana, Missouri, and Nebraska. The habits of the crows at these roosts are described, various observers being quoted. The ground underneath the roosts is covered sometimes to a depth of an inch or more, with a deposit of disintegrated pellets, from which the character of the winter food can be made out, and consisting, in the case of the Arlington roost, of hulls of Indian corn, seed of various kinds, sand and gravel, and chalky excrement. The seed were chiefly those of species of Rhus, especially the poison ivy, of flowering dogwood, and of sour gum. Illustrations are given of a pellet, and of the seeds most commonly eaten. The pellets consist of the indigestible portions of the food, which are disgorged after the soft nutritive matter has been removed in the stomach.

Animal food (pp. 26–55).—The methods of investigating the food habits and examining the stomach contents are described, the matter taken from the stomachs being mixed with water and the different ingredients then sorted out and identified. The average of the contents was found to be: Animal matter, 32.9 per cent; vegetable matter, 56.8 per cent, and mineral matter 10.3 per cent. Although the mineral matter is chiefly sand and gravel, and not food strictly speaking, it is taken

into consideration while dealing with the general proportions of the elements. Tables are given showing the contents of the stomachs, arranged according to the different kinds of food, and months of the year. The 32.9 per cent of animal contents are made up of mammals, 1.7 per cent; offal, 3 per cent; birds, poultry, and eggs, 1 per cent; reptiles, frogs, and fish, 2.2 per cent; insects and spiders, 23.5 per cent; and other invertebrates, 1.2 per cent. The mammal food was chiefly composed of mice and rabbits, though remains of ground squirrels, gophers, and some other small mammals were also found; and notes from field observers are given indicating the habits of crows in taking this kind of prey. Although there is evidence that crows eat poultry, wild birds, and the eggs of both, the amount is inconsiderable. Wild birds suffer more than poultry. A considerable proportion of the animal food is made up of reptiles, frogs, fishes, and invertebrates, frogs being most eaten, craytish, fish, snakes, snails, and small turtles following in the order mentioned.

Insect food (pp. 56-71).—Insect food was found in the stomachs of crows collected in every month of the year, and varied from 3 per cent in January to 53 per cent in April. The greatest amount of insects was eaten in April, May, and June, due to the presence at that time of nestlings, in whose stomachs were found one third more insects than were eaten by the adults. The generalizations drawn are that chiefly terrestrial species are eaten; that mainly large or medium-sized insects are taken; that hard bodied species are chosen; that insects with pungent or otherwise strong taste or odor are preferred; and that bright, and especially golden colored insects seem to be most attractive to crows. Grasshoppers, dung beetles, ground beetles (Carabidæ), May beetles, ground spiders (Lycosidæ), weevils, cutworms, soldier bugs, and ants form the bulk of the insect food, in the above order, but all the orders of insects were represented in the stomach contents. About as many beneficial and neutral as injurious species were eaten, but in point of individuals the injurious species are far ahead. Only two classes of beneficial insects were eaten to any great extent, the ground beetles and the soldier bugs, while grasshoppers and May beetles were eaten in considerable quantity, as were also to a lesser degree the weevils, click beetles, cutworms, and crane-flies. Notes from correspondents respecting the insect food of crows are included.

Vegetable food (pp. 72-87).—Tables are given showing the kinds of vegetable food in the stomachs, and the percentage of each, by months. Of this, corn constitutes about half, acorns, Rhus seeds, wheat, oats, grapes, and cherries following next in importance. Although some corn is eaten when it is sprouting, and again to a less extent when in the milk, the most is eaten during the fall and winter, and consists of waste grain. About 6 per cent of the total stomach contents was made up of mast, chiefly acorns, chestnuts, and beechnuts. Small grains and grass and weed seeds were eaten in small quantity, and fruits, almost wholly

wild, composed about one-sixth of the food. Nearly 5 per cent of the fall and winter food consisted of Rhus fruits, sumac and poison ivy, and bayberries (*Myrica* spp.).

Protection of crops (pp. 88–96).—The protection of crops from crows by various means, such as tarring seed corn, poison, and bounties, is historically discussed, and the coating of seed corn with coal tar and some dry powder, after first soaking in water, is recommended, as crows have a strong dislike to the flavor of tar.

The food of the common mole, H. GARMAN (*Kentucky Sta. Rpt. 1891, pp. XLI–XLV*).—This article consists of a preliminary report on the food of moles, against which complaint has been made of injury to seed corn. The stomachs of 14 moles were examined and the food contents are noted for each individual. Animal food was found in all of the 14 stomachs, and in 7 stomachs traces of vegetable tissue were also found. The vegetable matter, however, was thought to consist entirely of dead fibrous roots, probably eaten incidental to the animal matter taken, and not intentionally eaten. Two thirds of the food consisted of earthworms, and the remaining portion of insects, chiefly white grubs and beetles. In the opinion of the author the mole feeds entirely upon animal matter.

A laboratory guide for an elementary course in general biology, J. H. PILLSBURY (*Boston: Silver, Burdett & Co., 1895, pp. 1[illegible], pl. 1, dgms. 2*).—This is a work containing outlined directions for the preliminary dissection and study of organisms considered representative types of plants and animals. The forms treated range from the protococcus to the fern, and from the amœba to the frog.

On the destruction of mice, A. SEMPOLOWSKI (*Ztschr. Pflanzenkrank., 5 (1895), No. 6, pp. 333–335*).—Notes are given upon the use of *Bacillus typhi murium* for the destruction of mice.

On the granular leucocytes, G. L. GULLAND (*Proc. Roy. Soc., 59 (1896), No. 353, pp. 71–73*).

Examination of the contents of the stomachs of the fish crow (Corvus frugilegus) (*Deut. landw. Presse, 23 (1896), Nos. 34, pp. 296, 297; 35, pp. 307, 308*).

A few facts about the teredo, or ship worm, F. ROTH (*Forester, 2 (1896), No. 3, pp. 43, 44*).

The Royal Natural History, V, R. LYDEKKER (*London: F. Warne & Co., pp. 584, pls. 72, figs. 1,600*).—This volume of the series treats of the reptiles, amphibians, fishes, and the lowest chordates.

METEOROLOGY.

Meteorological observations at Kentucky Station, V. E. MUNCY (*Kentucky Sta. Rpt. 1891, pp. XLVII–LIII*).—Monthly summaries are given of observations during 1891 on temperature, atmospheric pressure, precipitation, sunshine and cloudiness, and movement of the wind. The annual summary is as follows: *Temperature* (degrees F.).—Maximum, 97, August 10; minimum, −6, December 29; mean monthly, 55.9; mean daily range, 18.6. *Pressure* (inches).—Highest, 29.59, February 24; lowest, 28.33, February 12; mean, 29.01. *Precipitation*

(inches).—Total, 36.32; number of clear days, 102; partly cloudy, 131; cloudy, 132.

Meteorological observations at Massachusetts Hatch Station, November and December, 1895, L. METCALF, C. A. KING, and J. L. BARTLETT (*Massachusetts Hatch Sta. Met. Buls. 83, pp. 4; 84, pp. 5*).—These include notes on the weather during these months and the usual summaries of observations at the meteorological observatory of the station. The December bulletin gives an annual summary for the year 1895. The more important data in this summary are as follows: *Pressure* (inches).—Actual maximum, 30.55, December 17; actual minimum reading, 28.25, February 8; mean reduced to sea level, 30.076; annual range, 2.30. *Air temperature* (degrees F.).—Maximum, 98, June 20; minimum, −6, February 6; mean, 48.5; annual range, 104; maximum mean daily, 83.4, June 2; minimum mean daily, 1.2, February 6; mean maximum, 57.7; mean minimum, 39.9; mean daily range, 17.6; maximum daily range, 41, June 10; minimum daily range, 2, December 5. *Humidity.*—Mean dew point, 39.5; mean force of vapor, 0.431; mean relative humidity, 74 4. *Precipitation.*—Total rainfall or melted snow, 44.46 in.; number of days on which 0.01 in. or more rain or melted snow fell, 119; total snowfall in inches, 61. *Weather.*—Mean cloudiness observed, 49 per cent; total cloudiness recorded by the sun thermometer, 2,145 hours, or 47 per cent; number of clear days, 118; number of fair days, 110; number of cloudy days, 137. *Wind* (prevailing direction).—NW., 13 per cent; S., 12 per cent; SW., 14 per cent; N., 10 per cent; W., 9 per cent; other directions, 45 per cent; total movement, 46,861 miles; maximum daily movement, 454 miles, December 31; minimum daily movement, 0 miles, March 7; mean daily movement, 128.4 miles; mean hourly velocity, 5.3 miles; maximum pressure per square foot, 43 lbs.—93 miles per hour, September 11. *Bright sunshine.*—Number of hours recorded, 2,363, or 53 per cent. *Dates of frost.*—Last, May 17; first, August 22. *Dates of snow.*—Last, April 3; first, October 20.

Nebraska Weather Review for 1895, G. D. SWEZEY and G. A. LOVELAND (*Nebraska Sta. Bul. 42, parts 1–13, pp. 100, maps 31*).—This includes general notes on the weather; monthly summaries of observations on pressure, temperature, precipitation, wind movement, cloudiness, etc., at some 121 different stations in the State. The data for 1895 are summarized as follows:

"The year 1895 was one of deficient rainfall and rather high temperature. The mean temperature for the State was 48.6° F., which is 0.8° above the normal. The highest was 110° and the lowest −31°.

"The mean pressure for the State was 30.06 in. The highest was 31.01, at North Platte, in February, and the lowest 29.12, at North Platte, in May.

"The average wind velocity for the State was 9.1 miles an hour; the highest was 59 miles an hour, at Lincoln, in March.

"The sunshine at Lincoln averaged 7.7 hours, or 63.3 per cent of the possible amount.

"The total evaporation at Lincoln amounted to 48.85 in.; at Omaha, 54.59; at Sioux City, Iowa, 52.79; and at North Platte, 48.64 in.

"The average precipitation for the State was 18.70 in. The normal as derived from the past 20 years is 23.33, leaving a deficiency of 4.63, or slightly less than as stated in the December bulletin which included less complete data.

"The average relative humidity at Lincoln was 67.7 per cent, at Omaha 63.4, and at North Platte 66.2. The lowest observed was 13 per cent, at Lincoln, in April."

The mean temperature for 20 years (1876–1895) was 48° F., and the average rainfall 23.33 in.

Meteorological report, N. HELME (*Rhode Island Sta. Rpt. 1894, pp. 213–217*).—This includes notes on the weather and tabulated results of observations on temperature, pressure, and precipitation for each month of 1894. The following is a summary of the observations for the year: *Temperature* (degrees F.).—Mean, 48.6; highest, 93, June 17 and July 29; lowest, −9, February; annual range, 102; highest monthly mean, 72.1, July; lowest monthly mean, 24.9, February; highest daily mean, 78, June 23; lowest daily mean, −1, February 24. *Precipitation* (inches).—Total (rain and melted snow), 48.19; greatest monthly, 9.14, October; least monthly, 0.50, June; *snowfall*—total, 75½; greatest monthly, 24½, January; least monthly, 4, March. *Weather*.—Number of clear days, 110; number of fair days, 130; number of cloudy days, 12; number of days on which 0.01 in. or more of rain fell, 114. *Air pressure* (inches).—Maximum, 30.54, February; minimum, 28.55, January; mean, 29.85.

High atmospheric pressure in January, DECHEVRENS (*Compt. Rend., 122 (1896), No. 6, pp. 351–354*).—Observations in England, France, and central Europe, but especially in Jersey, where the barometer at the Observatory of St. Louis showed a mean pressure for January of 766.12 mm. at a height of 55 meters and of 771.32 mm. at the level of the sea. This is claimed to occur periodically almost every 19 years under the combined action of sun and moon, the causes being discussed.

Actinometric observations made at the observatory of Montpellier in 1895, A. CROVA (*Compt. Rend., 122 (1896), No. 11, pp. 654–656*).

Observations of the sun at the Lyons observatory during the last three months of 1895, J. GUILLAUME (*Compt. Rend., 122 (1896), No. 10, pp. 590–598*).

Report of the Chief of the Weather Bureau, 1894 (*U. S. Dept. Agr., Weather Bureau Rpt. 1894, pp. 288*).—"The present volume of meteorological data, the third published by the Weather Bureau, contains the results of observations made during 1894, and, as a special contribution, a continuation of the detailed records of temperature, pressure, and wind at Pikes Peak and Colorado Springs, Colorado, begun in Part VI of the 1893 report."

The report includes a list of observing stations, with data on latitude, longitude, and elevation, etc.; instruments and instrumental corrections; hourly averages of atmospheric pressure, temperature, and wind movement for 28 selected stations; monthly and annual meteorological summaries for the different stations; monthly and annual mean temperature, annual extremes of temperature, and dates of first and last killing frost; monthly and annual precipitation; and miscellaneous meteorological tables and reports.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 23 (1895), Nos. 8, pp. 283–324, charts 5; 9, pp. 325–364, charts 6*).—In addition

to the usual summaries of meteorological observations with their accompanying explanatory notes, No. 8 contains notes by E. B. Garriott on high areas north of the St. Lawrence Valley in October, November, and December; by H. E. Frankenfield on weather forecasts in the State of Missouri; and by the editor on the value of Weather Bureau forecasts, the great drought of 1845 in northern Ohio, a region of heavy rainfall (Horse Cove, Macon County, North Carolina), the calculation of normal values, protection from frosts, how do rains and winds spread epidemics? do thunder storms advance against the wind? the cause of the low temperatures for August, an aurora in South Carolina and Kentucky, optical phenomenon (rainbow and yellow crosses observed by moonlight), the cold summer of 1816, a popular substitute for the barometer, and the carbonic acid gas in the atmosphere. No. 9 contains an article on meteorology and magnetism by F. H. Bigelow, and notes by the editor on Florida freezes for a century and a half, droughts in the Mississippi Valley, the weather in distant regions, the local storms of September 8 in Kansas, the earthquake of September 1, how to observe an earthquake, frosts in southern California—their prediction and prevention, and storm waves on the Great Lakes and the ocean.

A speculation in topographical climatology, W. M. DAVIS (*Amer. Met. Jour., 12 (1896), No. 12, pp. 372–381*).

Temperature observations on the snow covering during the winter of 1894–'95, P. POLIS (*Meteorol. Ztschr., 13 (1896), p. 1; abs. in Naturw. Rundschau, 11 (1896), No. 20, p. 250*).

North Carolina Weather, November, 1895, to February, 1896, H. B. BATTLE, C. F. VON HERRMANN, and R. NUNN (*North Carolina Weather Service Buls. 74, pp. 14, maps 2; 75, pp. 14, maps 2; 76, pp. 16, maps 2; 77, pp. 16, maps 2*).—The usual summaries of meteorological observations by the State Weather Service cooperating with the Weather Bureau of this Department.

WATER—SOILS.

Experiments in determining carbonates of lime and magnesia in soils, R. MAUZELIUS and A. VESTERBERG (*Ultuna Agl. Inst. Rpt. 1891, pp. 62–71*).—The authors investigated different methods of digestion of soil samples, with special reference to the determination of lime and magnesia. Since earlier experiments by Erdman with different samples of marl had shown that warm concentrated hydrochloric acid extracted considerably more of both oxids than did dilute hydrochloric acid (about 1 per cent), a number of comparative analyses of clays and marls were made with solutions of different strengths as follows: (1) ¼ normal (about 0.9 per cent) hydrochloric acid acting for an hour under constant agitation by means of a water motor, and (2) 1 per cent hydrochloric acid acting for 24 hours under occasional agitation. One gram of substance was treated with 100 cc. of the solution in the former method, and in the latter with 20 to 75 cc., according to the amount of carbonates present. The digestion took place at ordinary room temperature in both cases. Carbonic acid was determined in all samples by an apparatus similar to that of Fresenius. Five grams of soil was generally taken for this determination. The following results (p. 846) were obtained.

Lime, magnesia, and carbonic acid in clays and marls soluble in hydrochloric acid of different strengths. (In air-dry substance.)

Sample No.	Substance.	¼ normal hydrochloric-acid solution acting for 1 hour. Lime.	Magnesia.	Carbonic acid. Calculated.	Found.	Difference.	1 per cent hydrochloric-acid solution, acting for 24 hours. Lime.	Magnesia.	Carbonic acid. Calculated.	Found.	Difference.
		Per ct	Per ct	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct	Per ct.
1	Clay from Kattegat ...	5.36	0.84	5.13	4.37	+0.76	......	....	.....	......	.....
2	Clay surface soil	....	......	......	......	......	[1]0.55	[1]0.34	0.80	0.07	+0.73
3	Clay subsoil....	......	.....	......	......	......	.49	.35	.76	.05	.71
4	Clay, Upsala	1.32	.32	1.39	57	82	1.34	.37	1.46	.58	.88
5	...do	.63	.22	.74	.04	70	.63	.35	.88	.02	.86
6	.... do................	2.41	.16	2.07	1.48	59	...	......	......	... ..	.....
7	Marl Polacksbrn	14.25	.32	11.55	10.97	.58	14.43	42	11.79	10.97	82
8	Marl, gray, Ekeby ...	[2]8.68	[2].41	7.27	6.68	.59	.....	......	... ..	...	.....
9	Marl, brown, Ekeby ..	15.68	.47	12.83	12.36	47	.....	.....	......	..	......
10	Marl, Visby............	......	....	.....	......	......	15.47	1.16	13.44	13.00	.44
11	Marl Klinte	....	....	......	......	.....	13.70	.65	11.48	11.23	.25
12	Tertiary clay, gray	.21	.28	.47	.07	.40	......	......	..	.....	.....
13	Tertiary clay, brown	.24	.27	.48	08	.40	......	.	.....	. .	....
14	Keuper marl, reddish brown	4.63	3.19	7.12	6.48	64	.....	...	7.12	6.50	.62
15	Keuper marl, grayish-green	[3]11.83	[3]8.28	18.32	18.02	30	12.13	8.58	18.97	18.13	.84
16	Upper Silurian marl, Gotland.......... ...	7.65	1.19	7.31	7.09	22	7.90	1.28	7.62	7.14	.48

[1]Four per cent hydrochloric acid dissolved at ordinary temperature during 48 hours: 1.04 and 0.77 per cent of lime and of magnesia, respectively.

[2]One per cent hydrochloric acid dissolved at boiling heat 0.64 per cent and 1.41 per cent of lime and of magnesia, respectively.

[3]By extraction with 25 per cent hydrochloric acid an additional 0.17 per cent of lime and 1.35 per cent of magnesia were dissolved.

The results show that cold 1 per cent hydrochloric acid is sufficiently strong to dissolve the whole content of carbonates of lime and magnesia, even where the magnesia content is so high (as in the case of Nos. 14 and 15) that an insoluble residue of calcium magnesium carbonate (dolomite) might be expected. The data for "calculated carbonic acid" were derived from the percentages of lime and of magnesia dissolved by the acid solution; it will be seen that the calculated amounts of carbonic acid exceed those found by analysis by 0.22 to 0.85 per cent, average 0.58 per cent. The phosphoric acid and sulphuric acid present were determined in 4 samples, as follows:

Phosphoric-acid and sulphuric acid in clays and marls.

	Clay No. 2.	Marl No. 10.	Marl No. 11.	Marl No. 16.
	Per cent.	Per cent.	Per cent.	Per cent.
Phosphoric acid	0.09	0.07	0.11	0.12
Sulphuric acid......	.07	Not determined		.12

The quantities of acids found were not sufficient to account for the excess of dissolved bases, and this excess must therefore have been derived from silicic acid in the form of easily soluble silicates.

The authors recommend the method followed at the Halle Experiment Station (Germany) for the estimation of lime in soils,[1] checking

[1]See Landw. Vers. Stat., 38, p. 281 (E. S. R., 2, p. 524).

the results by a determination of carbonic acid in the sample before treatment. F. W. WOLL.

Amount of water in soils during July, 1895, M. WHITNEY (*U. S. Dept. Agr., Div. of Agricultural Soils Bul.* [illegible], *pp.* [illegible], *dgms.* 21).—The character of the weather during the month and the crop conditions are briefly discussed and data are reported in tables and diagrams showing the moisture in early truck soils at Mardela Springs, Maryland, and Toano, Virginia; in tobacco soils at Oxford, North Carolina (bright tobacco), Poquonock, Connecticut, and Newstead, Kentucky (shipping); blue grass and White Burley tobacco land at Lexington and Greendale, Kentucky; and in other soils at Wellington, Scott City, Haven, Garden City, Colby, Stafford, Ellinwood, Fowler, and Mankato, Kansas; and Geneva, Big Springs, and North Platte, Nebraska. Mechanical analyses are given of the truck soil from Toano, the grass soil from Lexington, and the tobacco soils from Oxford, Newstead, and Lexington. The moisture in these soils during June and July was as follows:

Moisture in different kinds of soil during June and July, [illegible].

	June	July
	Per cent	*Per cent*
Truck soil, Toano, Virginia	8.7	8.6
Grass soil, Lexington, Kentucky	19.7	20.4
Bright tobacco soil, Oxford, North Carolina	7.0	7.4
Shipping tobacco soil, Newstead, Kentucky	14.5	15.6
Burley tobacco soil, Lexington, Kentucky	19.7	20.5

"These figures are not those obtained from the daily samples, for the actual determinations vary considerably with the inequalities of the ground and from the errors arising from the methods of moisture determinations. The actual determinations are plotted on a chart and the figures in the table are taken from the chart as representing more nearly the average daily conditions of the field.

"While the moisture differs in the same soil from day to day and from week to week, the difference is proportionally the same on all the soils, showing that throughout the season crops growing on some soils have 2 or 3 times as much water at their disposal as on others under essentially the same climatic conditions."

The conservation of soil moisture by means of subsoil plowing, T. L. LYON (*Nebraska Sta. Bul.* 43, *pp.* 101–107, *fig.* 1, *pls.* [illegible]).—The strikingly beneficial and lasting effects on the growth of corn and sugar beets of subsoiling a fine upland loam at the station are described and illustrated and the successful experience of a farmer at Geneva, Nebraska, is given.

The following suggestions are made:

"Subsoil plowing, although a means of conserving moisture, does not produce it, and is, therefore, not a substitute for irrigation where the rainfall is too small to produce crops.

"Where there is a hard, dry subsoil, subsoil plowing is to be recommended.

"Where the subsoil is loose, gravelly, or sandy, subsoiling is probably unnecessary, or may even be injurious.

"Do not subsoil when the soil is very wet, either above or beneath, as there is

great danger of puddling the soil, thus leaving it in worse condition than before. This is one of the reasons why it is better to subsoil in the fall than in the spring.

"If the ground be subsoiled in the fall, the winter and spring rains have ample opportunity to soak in, that being the season of greatest rainfall and least evaporation.

"Subsoiling in the spring may be a positive detriment if the subsoil be extremely dry, as in that case the rain water is partially removed from the young plant by the absorption of the bottom soil. If the spring rains were heavy, this would not be a disadvantage."

On fallowing, P. P. DEHÉRAIN (*Compt. Rend., 122 (1896), No. 15, pp. 821–824*).—A triennial rotation of wheat, oats, and fallow is very common in Europe as a relic of the time when few forage plants were grown, little manure produced, and little was known of commercial fertilizers. The author maintains that the practice of fallowing has no excuse for existence at the present time when manure and fertilizers are abundant. It should be replaced by a system which keeps the soil covered and suppresses weeds.

Measurement of the odors of the air, A. GÉRARDIN and M. NICLOUX (*Compt. Rend., 122 (1896), No. 17, pp. 974, 975*).

Nitrates in water supplies, T. SCHLOESING (*Compt. Rend., 122 (1896), No. 15, pp. 824–829, figs. 2*).—A preliminary report on a study of the spring water of Paris, discussing the value of determinations of nitrates in choosing a source of supply of potable water. Analytical data are reserved for a future paper.

Potable water, F. COREIL (*L'Eau potable. Paris: J. B. Baillière et fils, pp. 359, figs. 135*).

Analyses of water, H. J. WHEELER (*Rhode Island Sta. Rpt. 1894, p. 137*).—Tabulated analyses with reference to sanitary condition of 5 samples of water sent to the station from different parts of the State.

Hygienic examination of water, FLÜGGE (*Deut. Viert. Öff. Gesund., 28, No. 1; abs. in Chem. Centbl., 1896, I, No. 12, p. 657*).—A partial résumé of this subject, with especial reference to the transmission of disease through water used for drinking and domestic purposes and to the methods employed in the examination of water.

Analyses of atmospheric waters collected at Catania from June, 1888, to September, 1889, G. BASILE (*Staz. Sper. Agr. Ital., 28 (1895), No. 9, pp. 545–574*).—Data regarding content of nitrogen in different forms and lime, magnesia, chlorin, sulphuric acid, and silica.

Investigations on the influence of plant cover on the height of the ground water, E. WOLLNY (*Forsch. Geb. agr. Phys., 18 (1895), No. 3-4, pp. 392–402, fig. 1*).

The agricultural charts of the Arrondissement of Meaux (Seine-et-Marne), France, J. BÉNARD (*Ann. Sci Agron., ser. 2, 1896, I, No. 2, pp. 264–270*).

Determination of the productive capacity of soils, A. BOUSCASSE (*Jour. Agr. Prat., 60, (1896), 1, No. 19, pp. 685–689*).—A popular article on the characteristics of a productive soil.

Account of an experimental field near Goedereede on land overflowed with sea water, I. G. J. KAKEBEEKE (*Orgaan Ver. Oudleer. Rijks Landbouwschool, 8 (1896), No. 90, pp. 5–7*).—Barley and oats yielded well-developed grain; the beans were badly wrinkled, and the potatoes had a very bad taste. From the results of this experiment the conclusion is drawn that on meadows overflowed with salt water, potatoes, flax, beans, and caraway must not be sown, while sugar beets, barley, and oats give a yield of very good quality.

The renovation of calcareous soils, P. GERVAIS (*Prog. Agr. et Vit., 25 (1896), Nos. 10, pp. 259–271; 11, pp. 287–297; 13, pp. 343–355*).

FERTILIZERS.

On the substitution of soda for, and its value in connection with, potash, H. J. WHEELER, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Rpt. 1894, pp. 168–182*).

Synopsis.—Phosphoric acid and nitrogen were applied uniformly to 48 sixtieth-acre plats. Potash and soda were substituted for each other in different amounts and proportions, using the chlorids and carbonates of potassium and sodium in different series, both with and without the addition of lime. Eleven varieties of plants were grown on each plat. The yields were generally greater with potash without soda than with soda without potash, and with the carbonates rather than the chlorids. The results indicate that soda was inferior to potash.

A brief review is given of work in this line. Four series of 12 sixtieth-acre plats were used, receiving a uniform application of 600 lbs. per acre of dissolved phosphate rock, 300 lbs. undissolved phosphate rock (floats), 180 lbs. fine ground bone, and 720 lbs. dried blood per acre. In addition potash and soda were used to test the value of soda as a partial substitute for potash.

Full amounts of each were used alone and combined with full, $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ the amounts of the others, and $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ of the full amounts of each were used in combination with equal amounts of the other.

The full amount of soda, 2.28 lbs. of sodium oxid per plat, was furnished in the form of 4.47 lbs. of sodium chlorid and 4 lbs. sodium carbonate, respectively. The full amount of potash, 3.35 lbs. per plat, was used in the form of 6.2 lbs. potassium chlorid and 5.94 lbs. potassium carbonate. In 2 series of plats the chlorids of potassium and sodium were used and in 2 others the carbonates. In previous work the soil, of which a chemical analysis is given, had been found so acid that some plants refused to grow on it. In order that the effect due to the neutralization of this acid might be the same a smaller quantity of sodium carbonate than of potassium carbonate was used in each case.

The field in which the plats were situated was in grass until 1893, when corn was grown. On June 6 and 7 beans, carrots, beets, corn, cucumbers, sorghum, millet, oats, ruta-bagas, and potatoes were planted on each plat. The planting was followed by excessive drought and the oats and corn were failures.

The yields secured are tabulated. They indicate that where potash was used without soda the yields were greater than where soda was used without potash. Where potash in increasing quantities was added to a full amount of soda the yields generally increased with the amount of potash, though not always in a uniform degree; but where soda in increasing quantities was added to a full amount of potash the results were less satisfactory.

The yields were generally greater with the carbonate than with the chlorids of potassium and sodium, and "those plants which showed

the greatest benefit from the use of the carbonate were among those which in experiments elsewhere were most benefited by the use of air-slacked lime."

It seems probable to the author that the carbonates reduced the acidity of the soil more than the chlorids, and that the use of air-slacked lime still further increased the yields of those crops most seriously affected by soil acidity. The use of lime was advantageous in connection with sodium and potassium carbonates, and much more so with sodium and potassium chlorids.

"The indications from the experiment this year are that soda was inferior to potash; but to what extent, if any, it is important as a plant nutrient in connection with potash in addition to the soda already existing in our soil, can only be ascertained by a repetition of the experiment perhaps for a number of years. Though the direct object of the experiment was not to compare the action of the chlorids and carbonates of potassium and sodium, it was evident that the latter produced much greater yields with certain crops than did the chlorids, and that this was due to the action of the carbonates in reducing the acidity or sourness of the soil seems probable. A similar beneficial action from the lime in connection with certain plants, which is in accord with previous experiments, is also evident."

Observations upon the growth of various plants upon an upland acid soil before and after liming, H. J. WHEELER, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Rpt. 1894, pp. 152-167, pls. 11*).—Experiments commenced in 1893 to test the influence of lime in connection with other fertilizers, especially nitrate of soda and sulphate of ammonia, on a large variety of field and garden crops grown on well-drained but acid soil (E. S. R., 7, p. 377) were continued during 1894. The yields of the different crops are tabulated and their appearance is shown in plates. The summary of results during 1893 and 1894 is as follows:

"Our sandy loam soil, where the natural drainage is good, has been found to be decidedly sour or acid, and some plants almost refuse to grow while others flourish upon it. By the use of the air slacked lime, which reduces or overcomes the acidity of the soil, the yields of a number of plants have been increased from 1 to 11 times; with a number of others the yields have been doubled, while with a few plants they have been reduced from one-half to one-fourth of those obtained without lime. The plants ordinarily grown in Rhode Island which have shown an injury from the use of 3 tons of air-slacked lime per acre are the pumpkin, watermelon, and Indian corn (field variety). In other experiments where smaller quantities of lime were used, Indian corn was slightly benefited or uninjured. The time of ripening of the watermelon was hastened by the use of lime, a fact which in our latitude fully compensated for the reduction in its yield. The greatest drawback to the use of lime which we have encountered is its tendency to increase the potato scab . . . [but] lime has invariably increased the yield of large tubers and frequently the total yield. . . . In regard to the maturity of the crop, that of the kohl-rabi was hastened remarkably by the use of lime, and that of the summer squash to some extent.

"Spinach and lettuce were more seriously affected by the acidity of the soil than any other crops grown, and almost failed in some instances to gain a foothold even though the seeds germinated well. The most important Rhode Island crops which were decidedly benefited by the use of lime were the beet, onion, muskmelon, cabbage, cauliflower, cucumber, barley, red clover, pea, and ruta-baga or Swedish turnip. Tobacco, sorghum, and wheat, though not Rhode Island crops, should also

be mentioned, owing to the fact that they are important crops elsewhere. A number of other crops less generally cultivated were also greatly benefited by lime.

"Marked differences have been observed between individual members of the same family of plants; for example, of 2 leguminous plants, the clover and the lupine, the former can not be grown successfully on our soil without lime, barnyard manure, or some other alkaline treatment, while the latter is injured by lime; again, in respect to the melon family, the muskmelon was a total failure without lime, while the total yield of watermelons was not increased by it. In regard to the cereals, barley was not a success without lime; wheat and oats were benefited by it in the order named, though in a less degree, while the rye derived but little benefit from it. . . .

"Perhaps the most important points brought out by this experiment are the following, namely, the necessity for the examination of upland soils relative to their acidity, and the recognition of its possible effect in connection with plant experiments, and also the necessity of employing a large number of plants in experiments by which it is hoped to establish general principles."

Testing the value of phosphoric acid in different forms, C. O. FLAGG, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Rpt. 1894, pp. 122-128*).—This is a report of progress in an experiment on 18 two-fifteenth acre plats, with equal money values of phosphoric acid from 8 different sources. Air-slacked lime was applied to one-half of each plat. Corn was grown on all the plats. Tabulated data are given for the yields of corn for the previous and present seasons. Analyses of the phosphatic materials used and a description of each are given.

"The experiment as now planned is to be conducted a number of years, using phosphoric acid in the same form each succeeding year. The crop will be changed each year to conform to some suitable rotation, using the same crop for all the plats."

Observations for the purpose of determining if the results secured in soil tests with a given plant are applicable to plants in general, H. J. WHEELER, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Rpt. 1894, pp. 140-151, pl. 1*).

Synopsis.—This is a soil test on 7 twentieth-acre plats with 37 varieties of plants. The results indicated that conclusions drawn from a soil test with a given plant may not apply to all others regardless of their character.

The authors review the work of testing the fertilizer requirements of soils in this country and in Europe.

Seven twentieth-acre plats, 10.47 by 208 ft., received nitrate of soda 480 lbs., dissolved boneblack 600 lbs., and muriate of potash 200 lbs. per acre, singly and in combination. To one-half of 1 plat air-slacked lime at the rate of 3 tons per acre was applied, part of the application being made in 1894. Corn had been grown on the plats for 4 years previous. In rows running across these plats 37 kinds of plants were grown, including the following: Clover, pea, bean, cowpea, soja bean, lupine, barley, oats, rye, wheat, millet, corn, sorghum, sunflower, mangel-wurzel, carrot, turnip, radish, parsnip, onion, salsify, squash, cucumber, pumpkin, kohl-rabi, cabbage, cauliflower, kale, lettuce, rape, tomato, pepper, potato, spinach, and muskmelon. The 2 rows of each variety were separated by more than 100 ft.

"The soil was in such an extremely exhausted condition that the application of two elements only rarely produced a good crop, and with many of the crops grown, . . . where phosphoric acid was lacking, the yield was practically nothing, even though sufficient nitrogen and potash was supplied."

Tabulated data are given for the weights of the crops secured on the various plats. The greater number of the plants enumerated indicated that phosphoric acid was more deficient than either of the other elements, and a list is given of 29 plants which showed decidedly the lack of phosphoric acid. The white bean, sunflower, and summer squash were evidently more benefited by potash than by phosphoric acid. From those plants which showed that phosphoric acid was most deficient a list of 13 is given which indicated a greater deficiency of potash than of nitrogen, and of 7 indicating a greater deficiency of nitrogen than of potash.

"The spinach positively refused to grow except on the limed plat, even though supplied with an abundance of phosphoric acid, potash, and nitrogen. This was doubtless due to the acidity of the soil, which affected the spinach more seriously than any other crop. The lettuce, for the same reason, produced only a minimum growth except where limed.

"The results of the foregoing experiment indicate that the conclusions drawn from a soil test with a given plant may not apply to all others regardless of their character. The results show in a very marked manner that the majority of plants with which we have experimented indicate a deficiency of available phosphoric acid in the soil, and it is possible that any one of these may be used for determining the fertilizer requirements of the others as far as concerns phosphoric acid.

"Another noteworthy feature of the results is that those plants which show an unquestionable lack of assimilable phosphoric acid in the soil do not agree among themselves as to the relative deficiency of potash and nitrogen.

"The most interesting point brought out by the experiment is that a soil shown by the cereals and many other plants to be exceedingly deficient in phosphoric acid should, when tested with certain other plants, appear to be chiefly deficient in potash.

"It will be evident from the foregoing that a test of the soil in question by means of the white bean or sunflower might have led to wholly erroneous conclusions as to the element most needed for the production of the greater portion of our ordinary crops."

Systems of manuring, W. H. JORDAN (*Maine Sta. Rpt. 1894, pp. 28–32*).—This is a continuation of work published in the Annual Report of the station for 1891 (E. S. R., 4, p. 129), and a summing up of the data of 7 years' experiments. These experiments were made on 4 plats containing $2\frac{1}{2}$ acres each, laid out in a 10-acre field of clay loam grass land in 1888. For 2 years grass was grown to determine the relative fertility of the plats. In 1890 the plats were plowed and the following fertilizers applied: Plat 1, 20 loads of stable manure per acre; plat 2, 1,000 lbs. of South Carolina rock, 66 lbs. of nitrate of soda, 16 lbs. of sulphate of ammonia, and 100 lbs. of muriate of potash per acre; plat 3, 500 lbs. of acid South Carolina rock, otherwise the same as plat 2; plat 4, no fertilizer. This was the only application of fertilizers made. The crops grown and the yields are given in the following table for each year except 1893, during which the plats were summer fallowed and tilled.

Crops grown and yields per acre during 7 years with one application of fertilizer.

Year.	Crop grown.	Plat 1, barn manure.	Plat 2, phosphoric acid, crude.	Plat 3, dissolved phosphate.	Plat 4, nothing.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1888, 1889	Hay, average	2,542	2,416	2,082	2,510.0
1890	Barley and peas, combined yield[1]	2,208	1,712	1,422	1,118.0
1891	Oats:				
	Grain	1,536	1,447	1,523	1,304.0
	Straw	2,282	1,534	1,449	1,176.0
	Total	3,818	2,981	2,972	2,480.0
1892	Barley hay	3,444	2,324	1,930	1,161.0
1894	Oats:				
	Green crop	9,968	10,264	7,608	6,340.0
	Dry matter	1,894	2,453	1,734	957.3
	Yield without fertilizers as calculated from the relative production of 1888-'89	966	919	766	957.3
	Gain caused by fertilizers in 1894	928	1,534	968	...

[1] Fertilizers applied this year.

The author concludes as follows:

"The commercial fertilizers have caused a marked increase of crop for at least 4 years after their application.

"The fourth crop was larger from the crude phosphate than from the dissolved.

"The first 3 crops were larger from the yard manure than from the commercial manures, but the fourth crop was larger from the latter."

The composition and use of fertilizers, L. L. VAN SLYKE (*New York State Sta. Bul. 94, n. ser., pp. 279–411*).—This is in part a revised edition of Bulletin 55 of the station (E. S. R., 5, p. 161), and gives a popular summary of information on the following topics: Chemistry of plants, plant food, and soils; materials used as fertilizers; purchase and use of fertilizers, including formulas for fertilizers for different kinds of farm crops; arithmetic of fertilizers, including notes on guaranties and valuation; and average composition and value of fertilizing materials and of farm crops.

Investigations on the foraging powers of some agricultural plants for phosphoric acid, W. BALENTINE (*Maine Sta. Rpt. 1894, pp. 167–170*).—A reprint of Bulletin 16 of the station (E. S. R., 6, p. 709; 7, p. 111).

The nitrogen question, O. STILLICH (*Fühling's landw. Ztg., 45 (1896), No. 10, pp. 311–319*).

The disinfection of liquid fertilizers, E. VAN ERMENGEN (*Ann. Sci. Agron., ser. 2, 1896, I, No. 2, pp. 271–275*).

The preservation of barnyard manure, WAGNER (*Landw. Wochenbl. Schles.-Holst., 46 (1896), No. 14, pp. 215–217; Ztschr. landw. Ver. Rheinpreussen, 64 (1896), No. 15, pp. 123–125*).

Lime and marl, A. STUTZER (*Mitt. deut. landw. Ges., 1896, No. 6, pp. 50, 51; Landw. Wochenbl. Schles.-Holst., 46 (1896), No. 14, pp. 220, 221*).

On the metamorphic gypsums of Algeria, L. GENTIL (*Compt. Rend., 122 (1896), No. 17, pp. 958–960*).

Potassic fertilizers, G. SMETS and G. SCHREIBER (*L'Engrais, 11 (1896), No. 20, pp. 467, 468*).

Natural and industrial phosphates, H. LASNE (*Ann. chim. anal. appliq., 1896, p. 85; abs. in Chem. Ztg., 20 (1896), No. 32, p. 113*).—Nitric acid is condemned as a solvent because the iron oxid is difficultly soluble in it; dilute sulphuric acid is too slow in its action, especially in gypsum; boiling concentrated sulphuric acid is too energetic in its action. Hydrochloric acid alone or with the addition of nitric acid is considered the best solvent. In the author's method the phosphate is evaporated to

dryness with hydrochloric acid. To each gram of substance an equal amount of 20 per cent hydrochloric acid and 20 cc. of water are added, the solution heated for half an hour at about 100° C., filtered, and made up to 100 cc. for analysis. If the phosphate contains the higher oxids of manganese a little formic acid or alcohol should be added before treatment with hydrochloric acid.

Superphosphate, J. LAMQUET (*L'Engrais, 11 (1896), No. 21, pp. 496, 497*).

The application of Thomas slag in the spring, P. WAGNER (*Mitt. deut. landw. Ges., 1896, No. 7, pp. 52-54; Landw. Wochenbl. Schles.-Holst., 45 (1896), No. 15, pp. 230-232*).

Fertilizer experiments, VON LIEBENBERG (*Mitt. Ver. Ford. landw. Versuchsw. Oesterr., 10 (1895), No. 2, pp. 113-122*).

Analyses of commercial fertilizers at Kentucky Station, M. A. SCOVELL (*Kentucky Sta. Rpt. 1891, pp. 2-6*).—A reprint of Bulletin 48 of the station (E. S. R., 5, p. 861).

Commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Rpt. 1891, pp. 51-80*).—A reprint of Bulletin 51 of the station (E. S. R., 6, p. 401).

Commercial fertilizers (*Kentucky Sta. Rpt. 1891, pp. 81-116*). A reprint of Bulletin 52 of the station (E. S. R., 6, p. 980)

Analyses of commercial fertilizers, W. C. STUBBS (*Louisiana Stas. Bul. 39, 2d ser., pp. 1113-1131*).—Explanatory notes on the fertilizer control in Louisiana, on the sources of nitrogen, phosphoric acid, and potash in fertilizers, and on the valuation of fertilizers, with a list of licenses issued and tabulated analyses of 79 samples of fertilizing materials, including acid phosphate, cotton-seed meal, tankage, bone meal, and mixed fertilizers.

Fertilizer analyses, H. B. BATTLE (*North Carolina Sta. Special Buls. 31, pp. 10; 32, pp. 13; 34, pp. 14; 35, pp. 16; 36, pp. 18*).—These special fertilizer bulletins contain, as usual, an abstract of the fertilizer law, explanations of terms used in fertilizer analyses, notes on the valuation of fertilizers, freight rates from the seaboard to interior points, with tabulated analyses and valuations of 633 fertilizing materials.

Fertilizer inspection in Rhode Island, H. J. WHEELER (*Rhode Island Sta. Rpt. 1891, pp. 129-136*).—Notes on the fertilizer control in the State and analyses, with comments, of 18 samples of fertilizing materials including dissolved boneblack, dissolved South Carolina rock, Thomas slag, floats, ground aluminum phosphate, salt, sodium carbonate, potassium nitrate, sulphate of potash and magnesia, muriate of potash, potassium carbonate, dried blood, sulphate of ammonia, wool waste, Peruvian guano, wood ashes, muck, and mixed fertilizers.

FIELD CROPS.

Field experiments with fertilizers, W. H. JORDAN (*Maine Sta. Rpt. 1891, pp. 16-28*).

Synopsis.—This is a summary of results obtained with different forms and combinations of fertilizers on 36 plats of clay loam soil during 9 years. In comparative tests of dissolved boneblack, ground bone, and fine ground South Carolina rock it was found that the insoluble phosphates were quite fully utilized by at least 3 crops (oats, peas, and corn), although not so completely as the dissolved phosphate. There was an increase of crop from every combination of fertilizing ingredients, but "there is no doubt of the superior influence of the mixture of the three. The increase of production was almost directly proportionate to the amount of fertilizer used." Barnyard manure gave greater yields than commercial fertilizers, but the results indicate that "a larger percentage of the materials furnished by the commercial fertilizers was appropriated by the growing crops."

This is a continuation of experiments begun in 1886 (E. S. R., 4, p. 129), and sums up the data acquired during 9 years. The field was a

clayey loam adapted to grass and grain, and was divided into 36 plats arranged in 2 tiers of 18 plats each. The plats were 8 rods long by 1 rod wide, with intervening strips 8 ft. wide in which were ditches to carry off surface water. The experiment was made in triplicate; 3 plats in different portions of the field received the same treatment.

Fertilizers were applied in 1886, 1887, 1889, 1893, and 1894. None were applied the other years.

The fertilizers were applied as follows:

Plats 1, 7, 13, 19, 25, and 31 received no fertilizer;

Plats 2, 8, and 14, dissolved boneblack 400 lbs. or dissolved South Carolina rock 500 lbs., muriate of potash 100 lbs., and sulphate of ammonia or nitrate of soda 200 lbs.;

Plats 3, 9, and 15, ground bone 360 lbs., muriate of potash 100 lbs., and sulphate of ammonia or nitrate of soda 200 lbs.;

Plats 4, 10, and 16, fine ground South Carolina rock 300 lbs., muriate of potash 100 lbs., and sulphate of ammonia or nitrate of soda 200 lbs.;

Plats 5, 11, and 17, muriate of potash 100 lbs. and sulphate of ammonia or nitrate of soda 200 lbs.;

Plats 6, 12, and 18, barnyard manure 40,000 lbs.;

Plats 20, 26, and 32, dissolved boneblack 400 lbs.;

Plats 21, 27, and 33, dissolved boneblack 400 lbs. or dissolved South Carolina rock 500 lbs., and muriate of potash 100 lbs.;

Plats 22, 28, and 34, dissolved boneblack 200 lbs. or dissolved South Carolina rock 250 lbs., muriate of potash 50 lbs., and sulphate of ammonia or nitrate of soda 60 lbs.;

Plats 23, 29, and 35, dissolved boneblack 300 lbs. or dissolved South Carolina rock 375 lbs., muriate of potash 100 lbs., and sulphate of ammonia or nitrate of soda 120 lbs.;

Plats 24, 30, and 36, dissolved boneblack 400 lbs. or dissolved South Carolina rock 500 lbs., muriate of potash 150 lbs., and sulphate of ammonia or nitrate of soda 180 lbs.

During the experiment crops were grown as follows: 1886, oats; 1887, oats; 1888, hay; 1889, fallow; 1890, peas; 1891, oats; 1892, peas; 1893, corn; 1894, corn. The yields for each group of plats for the 8 years in which crops were grown are tabulated. The results are classified and discussed with reference to the problems studied in the experiments in the order given below.

The relative utility of different forms of phosphoric acid (pp. 23–25).—Soluble and insoluble forms of phosphoric acid, combined with nitrogen and potash, were compared with nitrogen and potash, and with no fertilizer. The yields for 6 years are tabulated, together with the excess of yield over no fertilizer. The latter is shown in the table below:

Excess of yield per acre over no fertilizer with phosphoric acid from different sources.

	Oats 1886	Oats, 1887	Hay,[1] 1888.	Peas,[2] 1890.	Corn, 1893.	Corn,[1] 1894.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Basal fertilizer[4] and dissolved boneblack or dissolved South Carolina rock	2,236	1,400	132	444	1,020	2,004
Basal fertilizer[4] and ground bone......	1,756	566	234	516	931	2,092
Basal fertilizer[4] and fine-ground South Carolina rock................	1,388	1,100	....	356	681	1,730
Basal fertilizer[4]........................	836	700	−332	16	510	1,049

[1] No fertilizer applied in 1888

[2] Fertilizers applied in 1889 and land summer fallowed.

[3] Yield of dry matter.

[4] Basal fertilizer: Muriate of potash and nitrate of soda or sulphate of ammonia.

The author concludes that the phosphoric acid of the bone and ground South Carolina rock was quite fully appropriated, though not to the same extent as dissolved phosphate, and that the forms of phosphoric acid insoluble in water were utilized by at least 3 kinds of farm crops (oats, peas, and corn).

Effect of partial and complete fertilizers (pp. 25, 26).—Compared with no fertilizer, the excess of yield per acre for 8 years with phosphoric acid was 1,690 lbs.; with phosphoric acid and potash, 4,956 lbs.; with nitrogen and potash, 2,770 lbs.; and with nitrogen, potash, and phosphoric acid, 7,331 lbs. "While there is an increase of crop from every combination of ingredients used, there is no doubt of the superior influence of the mixture of the three."

Relative effect of different amounts of fertilizers (p. 26).—The amounts of complete fertilizer applied per acre on 3 sets of 3 plats each were 360, 595, and 830 lbs., respectively. A tabulated summary is given covering 8 years. During this time the total increase in yield with the above applications over the unfertilized plats was 3,688, 5,907, and 9,193 lbs., respectively. "The results show that the increase of production has been almost directly proportioned to the amount of fertilizer used."

Comparative results with commercial fertilizers and with stable manure (p. 27).—The data bearing on this question are given in the following table:

Yield per acre of air-dry fodder with commercial fertilizers and with stable manure.

Group	Fertilizers applied per acre: Dissolved South Carolina rock	Muriate of potash	Sulphate of ammonia or nitrate of soda	Stable manure	Total yield in 8 years	Excess of yield over plats not fertilized: Total	Annual
	Pounds	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*	*Pounds*
1				...	11,050		
2	250	50	60		17,738	3,688	461
3	375	100	120		19,957	5,907	738
4	500	100	200		21,481	7,331	916
5	500	100	180		23,243	9,193	1,149
6				20	26,751	12,701	1,588

"The fact of greater production from the stable manure than from the commercial fertilizers is what would reasonably be expected when we consider the larger amount of plant food contained in the former. . .

"It seems quite evident that a larger percentage of the materials furnished by the commercial fertilizers has been appropriated by the growing crops than was the case with the stable manure. This may be due, however, to the smaller supply from commercial sources."

The profitable amount of seed per acre for corn, W. H. JORDAN (*Maine Sta. Rpt. 1891, pp. 33, 34*).—An acre of land, manured with 5 cords of barnyard manure and 500 lbs. of commercial fertilizer, was divided into 12 plats, 3 series of 4 plats each. On 1 plat in each series the kernels were planted 6 in. apart, on another 9 in., and on

another 12 in. When the kernels were glazed, the corn was cut, weighed, and sampled.

The following table gives the yield per acre of the corn as harvested and of dry matter:

Yield per acre of corn drilled at different distances.

	Yield of green crop per acre.	Dry matter in green crop.	Yield of dry matter per acre.
	Pounds.	*Per cent.*	*Pounds.*
Kernels 6 inches apart or 6 in 3 feet	21,315	21.1	4,497
Kernels 9 inches apart or 4 in 3 feet	22,530	20.9	4,709
Kernels 12 inches apart or 3 in 3 feet	20,190	20.5	4,139

Tabulated analyses are given of the corn grown in each series. In this experiment the largest yield of both green crop and dry matter was when the kernels were planted 9 in. apart. The grain from the different quantities of seed was of practically uniform composition.

Experiment with leguminous plants, C. O. FLAGG, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Rpt. 1894, pp. 111–120*).

Synopsis.—A trial with 18 kinds of legumes. The application of 150 lbs. of nitrate of soda per acre seemed more profitable than 450 lbs., and, with about half the plants, more profitable than none. The clovers seemed most benefited by the smaller application, while with the soja bean this application did not pay the cost the second year.

This is a continuation of work published in the Annual Report of the Station for 1893 (E. S. R., 7, p. 396), on the effect on common leguminous plants of applying nitrogen at different rates.

As in the previous year, 3 plats received 1,200 lbs. of phosphate rock and 180 lbs. of muriate of potash per acre. Nitrate of soda was used on 2 plats at the rate of 150 and 450 lbs. per acre, respectively; the third plat received no nitrogen.

June 13 red, mammoth, and Bokhara clover, yellow lupine, English horse beans, 5 varieties of soja beans, 5 of Japanese beans, golden wax beans, peas, cowpeas, and spurry were sown on each of the 3 plats.

A majority of the plants gave the largest yields with 450 lbs. of nitrate of soda, but in no case was the increased yield over that on the plat manured with 150 lbs. sufficient to cover the expense of the additional fertilizer applied.

In the case of about one-half of the different kinds of plants the increased yield with 150 lbs. of nitrate of soda as compared with the yield without nitrogen was sufficient to pay for the cost of the nitrate of soda. With the remainder it was doubtful if the application paid.

With the clovers the yield was largest with 150 lbs. of nitrate of soda and decreased when the large quantity was applied.

With most of the soja beans the increased yield with nitrogen was not sufficient to cover the cost the second year, while the first year there was a slight profit from applying 150 lbs. of nitrate of soda.

Compiled analyses are given of some leguminous plants and of corn, oats, and millet for comparison, and descriptive notes on some of the legumes tried.

Use of lime for oats, C. O. FLAGG, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Rpt. 1894, pp. 111-114, dgm. 1*).

Synopsis.—The yields are given of green oats grown on plats manured with phosphoric acid, potash, and different forms of nitrogen, a section of each plat having received a dressing of lime the year previous. The largest increase from liming was where the sulphate of ammonia was used.

On 11 twentieth acre plats dissolved boneblack and muriate of potash were applied uniformly. In addition nitrate of soda was applied at different rates on 2 plats, sulphate of ammonia on 3 plats, and dried blood on 3 plats. A section of each of the plats had received air-slacked lime the previous year. The plats had been in corn the 4 preceding years. April 9 they were plowed, harrowed, and seeded to oats at the rate of 3 bu. per acre. The oats germinated well and made a fine growth on the limed sections, while on the unlimed sections the crop was "yellow and sickly in appearance, and unthrifty and spindling in growth." The entire crop was cut July 12, before the grain had matured.

The yields of green oats on limed and unlimed plats are shown in the following table:

Yield of green oats on limed and unlimed soil

	Nitrogenous manure applied							
	Nitrate of soda		Sulphate of ammonia			Dried blood		
	300 lbs per acre	450 lbs per acre	116 lbs per acre.	232 lbs per acre	348 lbs per acre	220 lbs per acre	440 lbs per acre	660 lbs per acre
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Limed plats	8.194	7.722	6.776	8.667	9.297	5.358	7.249	8.982
Unlimed plats	7.073	6.761	3.306	2.600	2.246	3.546	4.784	5.206
Gain on limed plats	1.121	0.961	3.470	6.067	7.051	1.822	2.465	3.776

"From the above table it is evident that the application of air-slacked lime to the sulphate of ammonia plats gave greater yields than upon either the nitrate of soda or the dried blood, although the gain in all cases was much more than sufficient to cover the extra expense of liming. The result obtained is strong evidence that oats require an alkaline soil for their most productive growth, and that the sulphate of ammonia, especially, is used to disadvantage on an acid soil. Other experiments have pointed toward the same conclusion."

Small grains and potatoes, L. FOSTER and F. W. TRAPHAGEN (*Montana Sta. Bul. 7, pp. 173-187*).—The trial plats "varied from a single row to one-tenth of an acre." Nearly all the grains were drilled in rows 14 in. apart and kept free from weeds by cultivation. The rainfall for April, May, June, and July is given. Only one irrigation was given, viz, between July 19 and 25.

The average analysis is given of 20 samples of soil taken from different parts of the station farm.

Wheat, test of varieties (pp. 176–179).—A list of 88 varieties is given. Of these 40 are known only by number, the names having been lost. Sutherlin No. 1 gave at the rate of 82.5 bu. per acre, the largest yield, followed by Glyndon No. 750, 66 bu.; Ladoga, 63.3 bu.; and Red Fife, 59.1 bu. Analyses are given for 35 varieties.

Oats, test of varieties (pp. 180–182).—A list of 48 varieties is given, and the per cent of hull and kernel is given for 35 varieties. Prize Clinton gave the largest yield, 109.1 bu. per acre, followed by White Canadian 105.4, Early Everett 105.4, Lincoln 104.8, Jeanette 103.1, and Egyptian No. 2, 103.1 bu.

Barley, test of varieties (pp. 183, 184).—Of 23 varieties, Duck Bill gave the largest yield, 72.9 bu. per acre, followed by Canadian Black 71.5 bu., Manhattan 68.7 bu., and Improved Black 61.8 bu. Analyses are given for 24 varieties.

Potatoes, test of varieties (pp. 185–187).—The potatoes were planted May 23, on land that had lain idle the previous three seasons. Of 25 varieties, the largest yield was given by Alexander Prolific, 333 bu. per acre, followed by American Wonder 320 bu., Arizona 294, The Delaware 289 bu., and Early Oxford 280 bu. Analyses are given of 21 varieties. Brief notes are given on the preliminary treatment of seed tubers with a solution of corrosive sublimate.

Irish potatoes, H. N. STARNES (*Georgia Sta. Bul. 29, pp. 297–351, pls. 10, figs. 7*).—*Culture* (pp. 297–318).—This is a popular illustrated article on the culture of potatoes, treating of the preparation of the soil, fertilizers, size and distance of seed pieces, time and depth of planting, cultivation, harvesting, the second or summer crop, the fungus diseases and insect pests, with remedies, preservation, and varieties.

Variety tests (pp. 319–342).—The trial in 1894 embraced 60 and in 1895 240 varieties. The yields of all and the starch content of 56 varieties are tabulated.

For early planting the author recommends as first choice Pride of the South, Early Rose, Beauty of Hebron, Carman No. 1, and Peerless; for summer crop, Lookout Mountain of previous season's growth.

Trenching (pp. 342–344).—On the 10 plats under trial the trenching was done by subsoiling and in addition the earth was shoveled out in 8 of the rows. The author stated that trenching and planting 6 in. deep gave better results than planting 8 or 10 in. deep.

Planting at different rates (pp. 344, 346).—On 17 plats pieces weighing from 2 to 3 oz. and whole tubers (6 oz.) were planted at various distances between 4 in. and 2 ft. The author states that 1 oz. pieces (or 4 oz. tubers quartered), planted at intervals of 12 in., will probably give the best average returns.

Planting at different depths (pp 346, 347).—Of the 7 depths tried from 2 to 8 in., the largest returns were from a depth of 4 in.

Mulching (p. 348).—On one plat the seed pieces were dropped 12 in. apart in the furrow and covered by the furrow slice of the succeeding furrow, in which more seed was dropped, and so on, 54 bu. of seed being used to the acre. The plat was then mulched with pine straw. The net yield was 110.5 bu. and that on the adjoining cultivated plat 105.8 bu. Mulching is not recommended for field culture.

Spraying tests (p. 349).—On 4 quarter-acre plats spraying with Bordeaux mixture, Bordeaux mixture and soap, and modified eau celeste at intervals of 10 or 12 days was unsatisfactory.

Fertilizer tests (pp. 350–352).—On 14 plats, on a poor soil, 600 lbs. of superphosphate, 250 to 500 lbs. of nitrate of soda, and 150 to 300 lbs. of muriate of potash were applied in combination, half under and half over the seed, all under, and all under with additional applications of 125 to 500 lbs. of nitrate of soda.

Thirty seven and a half pounds of muriate of potash per acre was considered the maximum application for profit. Putting all the fertilizer underneath the seed is advised.

Experiments with potatoes, W. M. MUNSON and H. P. GOULD (*Maine Sta. Rpt. 1894, pp. 51–53*).—The relative merits of ordinary culture and the Rural New Yorker trench system were compared on 2 twentieth acre plats, using Early Rose potatoes. The soil was a strong clay loam, naturally moist and thoroughly underdrained. After plowing and harrowing, the tubers on one plat were planted in furrows 4 in. deep, with fertilizers applied on the surface. On the other plat furrows 8 in. deep were pulverized to a depth of 14 in. and filled to 6 in. The fertilizer was then applied in the furrow and covered with 2 in. more of soil, the tubers being then planted as on the first plat.

The total number of tubers harvested was greater by the trench method, but the gain was wholly in those which were small and unmarketable. The cost of labor in preparing the plats was for the trench system nearly twice that of the usual method. The results are regarded as not justifying the extra labor involved in the trench system.

Cultural experiments with different varieties of rye, G. LIEBSCHER (*Arb. deut. Landw. Ges., No. 13, pp. 85*).—This is a report on the results of coöperative cultural tests of rye carried on during the years 1889 to 1894, inclusive, embracing 784 plats distributed over 167 farms. A summary of the meteorological data for the years 1893 and 1894 is given, followed by extracts from the reports of those participating for the years 1893 and 1894, and a general discussion of the results of the 6 years' work.[1]

The author considers that the experimental errors in variety tests are very large, often greater than the differences between the varieties; that we have no means of recognizing the causes and the extent of

[1] Earlier work in this line was published in Jahrb. deut. Landw. Ges., 5 (1890), p. 635, and 8 (1893), p. 171.

these faults of method in individual cases; and that successful fertilizer tests are always much easier and more trustworthy than variety tests; with the latter we can reach sure results only by repetitions on numerous farms during several years. In the improvement of grains the differences in yield in one or a few experiments are not sufficient to demonstrate the importance of the varietal differences; these can be deduced only from a great number of experiments carried on in different years and under different conditions of soil and climate.

Arranged according to yield of grain the varieties tested stood as follows: Petkuser, Improved Zealand, Champagne, Schlanstedt, Pirnaer, Besthorn Giant, New Göttingen, Probsteier, Miros, Oberwarthaer, and Sagnitzer. Averaging all the trials the proportion of grain to total yield of straw and grain varied between 28 per cent and 37.4 per cent, the average being 32.8 per cent. This relation was influenced by the weather, the soil conditions, and the variety.

The author also discusses the suitability of particular sorts for the different climatic conditions and for the different soils in which they were grown.

An investigation was made as to the size and composition of the ideal type of rye kernels. For all trials the average weight of 1,000 kernels was 26.50 gm. The protein content rose to 18.72 per cent and fell to 7.17 per cent in wholly normal samples; the average was 11 per cent. The author considers these variations due to the meteorological conditions. There was practically no difference in the fat content of the different varieties, the range being between 1.43 and 1.46 per cent. This slight variation may be accounted for by the differences in the degree of ripeness of the samples when cut.

Field experiments with wheat, C. M. CONNER (*Missouri Sta. Bul. 21, pp. 16*).—This is in continuation of work published in Bulletin No. 15 of the station (E. S. R., 3, p. 167).

Each year the tests were made on different plats on ground of uniform character. The previous crops, the meteorological conditions, and the yield of grain and straw per acre for 94 varieties are given. There was practically no difference between the yields of the bearded and beardless varieties, and but little between the yield of large and small kernels.

The author concludes as follows:

"The varieties producing the highest average yield for 4 or more years were as follows, and in the order named: Fultz, Extra Early Red, Currell Prolific, Hindostan, Jones Winter Fife, American Bronze, and Missouri Blue Stem, all of which had an average yield of more than 30 bu. per acre.

"The varieties producing the highest average yield for 3 years were as follows, and in the order named: Wharton Favorite, Everitt High Grade, Michigan Amber, Red Chaff, and Hybrid Mediterranean, all of which gave an average yield of more than 32 bu.

"The varieties producing the highest average yield for 2 years only were Extra Early Oakley, Coryell, and Democrat, all of which had an average yield above 35 bu.

"The varieties producing the highest yield for 1 year only were Rudy, Valley, Oregon, Swamp, and Longberry, all of which produced more than 36 bu. per acre.

"The yield and quality of a crop of wheat may be increased by the use of superior seed.

"A mixture of varieties has resulted in an increased yield over the average of the same varieties grown separately."

Trials of alfalfa, C. O. FLAGG, J. D. TOWAR, and G. M. TUCKER (*Rhode Island Sta. Rpt. 1894, pp. 120–122*).—This is a report on an attempt, begun in 1892, to grow alfalfa on a light sandy soil resting on a gravelly subsoil with an application of commercial fertilizers. The plants of the first sowing died during the following winter and a second sowing was made.

Corn as a silage crop, W. H. JORDAN (*Maine Sta. Rpt. 1894, pp. 150–152*).—A reprint of Bulletin 11 of the station (E. S. R., 6, p. 34).

Tests of fertilizers on maize, A. CARRÉ (*L'Engrais, 11 (1896), No. 20, pp. 468–470*).

The culture of cotton in Egypt, H. VILMORIN (*Rev. Sci., ser. 4, 5 (1896), No. 19, pp. 605, 606*).—A report to the Society of Agriculture.

Grain, thick and thin seeding, R. H. MCDOWELL (*Nevada Sta. Bul. 27, pp. 3–10, 14*).—During 4 years wheat was grown on from 4 to 7 irrigated quarter-acre plats. The amount of seed sown varied from 30 to 120 lbs The results are tabulated. The author states that for 2 years the best yield was from 105 lbs. of seed per acre and for 2 years from 75 lbs. A list of questions was sent out to farmers and 6 replies are given.

Potatoes, W. M. MUNSON (*Maine Sta. Rpt. 1894, pp. 152–155*).—A reprint of Bulletin 12 of the station (E. S. R., 6, p. 632).

Potatoes, different dates of planting, R. H. MCDOWELL (*Nevada Sta. Bul. 27, pp. 10–11*).—Ten plantings of 4 varieties of potatoes were made on irrigated land at intervals of 10 or 11 days, beginning March 31 and ending June 30. At every planting 20 hills of each variety were planted, 10 with half potatoes and 10 with whole ones. The results, which are inconclusive, are tabulated.

Report on variety tests of potatoes, H. WEISSFLOG (*Fühling's landw. Ztg., 45 (1896), No. 10, pp. 328–331*).—A test of 60 varieties, including 2 American sorts.

Coöperative tests of different varieties of potatoes, E. VON PROSKOWETZ (*Mitt. Ver. Ford. landw. Versuchsw. Oesterr., 10 (1895), No. 2, pp. 101–112*).—The trials were without definite results.

Ramie (*Bot Dept. Jamaica, Bul., vol. 3, No. 4, pp. 73–81*).—Notes are given upon the culture of ramie and its preparation for market.

Sorghum cane, A. M. PETER (*Kentucky Sta. Rpt. 1894, pp. XII–XIII*).—Results are tabulated for the analyses of cane juice of Colman's sorghum grown from the seeds of a number of selected heads and harvested at different dates in October.

A study of the plant food materials used by the sugar beet, W. SCHNEIDEWIND and H. C. MÜLLER (*Jour. Landw., 44 (1896), No. 1, pp. 1–30*).

On the amounts of ammonia and nitric nitrogen in beets, H. PELLET (*Neue Ztschr. Rübenz. Ind., 36 (1896), No. 19, pp. 207–210*).

Various observations on the culture of the sugar beet on light soils, F. SCHIRMER (*Landwirt (1895), No. 80, p. 475; abs. in Centbl. agr. Chem., 45 (1896), No. 4, pp. 246, 247*).

Influence of sugar-beet culture on the increase of the gross yield of grain and of the products arising from stock keeping, W. LILIENTHAL (*Deut. landw. Presse, 23 (1896), No. 39, p. 339*).—The results are given on 8 landed estates showing the increase in the yield of grain and in the returns from live stock keeping after the introduction of beet culture.

Potash for beet fields (*Neue Ztschr. Rübenz. Ind., 36 (1896), No. 15, pp. 165, 166*).

Sowing a mixture of wheat and oats, L. DEGRULLY (*Prog. Agr. et Vit., 13 (1896), No. 16, pp. 423, 424*).—The usual mixture consisted of $\frac{2}{3}$ wheat and $\frac{1}{3}$ oats. In the vicinity of Ariège on a calcareous clay soil, producing an average of 7 to 8 hectoliters

of wheat, the mixture yielded 7 hectoliters of wheat and 8 of oats, an increase of 8 hectoliters of oats. This mixture has been sown for some time in parts of France with good results.

The tobacco industry of India and the far East, C. TRIPP (*Indian Agr., 21 (1896), No. 5, pp. 154-158*).—A popular article describing the soil, climate, and the labor system in Sumatra and India, and the methods of cultivating tobacco.

What influence has the time of sowing on the yield at harvest? A. HECKER (*Fühling's landw. Ztg., 45 (1896), No. 7, pp. 222-225*).—A discussion of the results obtained by Haberlandt and Wollny, with tabulated data. Haberlandt concluded that the thriftiness of the summer crops decreases the later they are sown in the spring. By delaying the sowing the weight of straw, stubble, and roots is increased, while the yield and quality of the crop are lessened. Later sowings are more subject to attacks of smut and rust. Wollny considers that there is a particular time in spring for the sowing of each species of plants to obtain the highest yield. This time is dependent upon the season. In general the earlier the seed is sown the more thrifty the growth. The weight of straw compared with weight of grain increases with the lateness of sowing. The period of development begins more quickly and passes more rapidly the later the sowing takes place, and dates of ripening will approach each other closely regardless of dates of sowing.

HORTICULTURE.

Report of the horticulturist, W. M. MUNSON and H. P. GOULD (*Maine Sta. Rpt. 1894, pp. 53-73, pls. 1, figs. 3*).—This consists of notes on work carried out in the horticultural division during the year on sweet corn, tomatoes, and small fruits.

Sweet corn (pp. 53, 54).—This gives data of a comparative test of 15 varieties of sweet corn, of which Early Cory and Dreer Extra Early matured first and are recommended for early varieties, while Crosby and Perry Hybrid are the selections for medium and late use.

Tomatoes (pp. 54-66).—This consists of historical notes on the culture of tomatoes, the forcing of tomatoes in winter, and field notes.

Brief illustrated directions are given for the construction of a greenhouse heated by hot-water pipes and for the preparation of the benches. A comparison of box culture with open beds showed that earlier and better fruit was obtained when boxes were employed. Boxes 18 in. square and a foot deep are preferred, having about an inch of charcoal and clinkers in the bottom, and the soil used consisting of well manured garden loam. Training the plants to a single stem, on which the terminal bud should be pinched off when the plants are about 5 ft. high and have set 4 or 5 clusters of fruit, is considered best, the ripening clusters of fruit to be supported from above by means of slings of small cord. Artificial pollination, which can be simply done by tapping each plant with a padded stick about noon on bright days, is necessary. A temperature of 60° at night and from 70 to 80° during the day brought the best results. The average production per plant should be about 2 lbs. of fruit. Plants from house and from field grown seed were compared, with conflicting results, probably due to varietal differences. It is believed, however, that by forcing plants to early development in

the house and limiting the amount of fruit borne, a strain of unusual vigor for house culture may be produced.

The varieties Lorillard, Optimus, and Chemin Market have given best results for forcing, being smooth, firm, and of medium size. A few plants of Golden Queen, for contrast with red varieties, are suggested.

In the field experiments cultural methods rather than variety testing received attention. To correct the legginess of plants that had become drawn and spindling in the house before setting out in the field, a dozen plants of each of the 3 varieties, Ithaca, Nicholson, and Osceola, were cut back 4 in., others being left undisturbed for comparison. The results showed that in almost every instance the plants which were cut back were somewhat delayed in maturing fruit, but were of more vigorous growth, and in the end produced a larger yield. Plants which were mulched matured fruit a few days earlier, but in other respects plants which received cultivation bore superior fruit. Experiments with frequent cultivation as compared with infrequent were inconclusive; late varieties, however, seeming to be benefited by more culture.

Small fruits (pp. 66-73).—Cultural and descriptive varietal notes are given for strawberries and raspberries, 28 varieties of strawberries being noted and 7 of raspberries. The following are recommended: *Strawberries*—Bubach, Crescent, Haverland, Sharpless, Warfield, Bederwood, and Michel. *Raspberries*—Cuthbert, Golden Queen, and Shaffer. Blackcaps are not recommended for general culture.

General observations respecting the care of fruit trees, with some reflections upon weeds, L. H. BAILEY (*New York Cornell Sta. Bul. 102, pp. 507-528, figs. 1*).—This bulletin gives a popular account of the neglect with which orchards were formerly and are sometimes now treated, and presents directions for the care of fruit trees according to modern principles. It is stated that mistakes in the choice of land and sites for orchards and neglect of tillage are the commonest faults of the orchardists of western New York. The advantages gained by tillage are briefly enumerated, and it is urged that tillage should commence when the orchard is planted and early every season should be applied to the entire surface and continue until late summer or early fall, care being taken so to perform the cultivation as to keep the land in fine and uniform tilth. Illustrations are given of thrifty roots of trees in well-tilled soil as compared with those in hard, untilled land.

The inadvisability of attempting to grow other crops, and especially grass and hay, in orchards is urged, and the necessity of supplying an abundance of available plant food is strongly emphasized. Old orchards may sometimes be rescued by tillage and pruning, but remedial treatments are generally begun too late in the life of the orchard. Girdling some of the branches often induces fruitfulness by checking the growth. The importance of pruning and spraying is urged.

Profit and loss in orchards is frequently a question of varieties.

Care in the selection of trees to be planted is dwelt upon; and lists are given of several leading varieties of apples and pears that are self-sterile and others that are self-fertile.

The existence of weeds is believed to be an advantage to farmers by necessitating a constant struggle against them, and thus insuring rotation of crops and thorough cultivation. Good crops and good tillage are stated to be capable of keeping down all weeds.

Evaporated raspberries in western New York, L. H. BAILEY (*New York Cornell Sta. Bul. 106, pp. 143-178, figs. 27*).

Synopsis.—This bulletin describes and discusses the process of evaporating raspberries, tower driers being recommended for the purpose, and also contains brief directions for the growing of raspberries, advising the culture of the Gregg variety.

The evaporator (pp. 143-161).—It is stated that about 1,500 tons of evaporated raspberries are marketed each year from western New York, 1,000 tons being produced in Wayne County alone. The history of the industry of fruit, and especially berry, evaporation is briefly given, according to which the drying of raspberries was first begun in 1868. Five different types of evaporators are mentioned: Kilns, horizontal driers, towers, steam tray evaporators, and air-blast evaporators.

The kilns consist of slatted floors under which hot air or smoke pipes or steam pipes are conducted, and are chiefly used because of their cheapness, for the quality of their product is uneven and not high.

Horizontal evaporators, in which the trays of fruit are moved horizontally or obliquely across the heating surface, are only mentioned by name.

The tower or stack evaporator in various forms is the style chiefly used in the State, and is that recommended by the author. The preferable style is a chimney-like structure of brick resting in the basement of a building and extending up through the roof, with a coal or wood furnace in the base. The heated air rises through the shaft, drying the fruit as it rises, and carrying the vapors into the outside atmosphere. The fruit is spread on trays, usually about 19 in. square, which are put into the stack from the first story and gradually raised by some handy lifter, new trays of fruit being continually added from below. The heat in the stack is about 200° F. at the bottom and about 100° at the top. An average stack about 10 ft. high holds 25 trays of 16 qts. each. Trays of fresh berries are inserted every 10 minutes and thus discharged with the berries practically dried in about 4 hours. The construction and lifting mechanism of the stacks are described and figured with some little detail. The bottoms of the trays consist of wire screen of about ¼ in. mesh. A little over 3 qts., or 4 lbs., of fresh blackcaps are required to make 1 lb. of marketable product under ordinary conditions. After the berries are removed from the trays, they are piled several inches deep in a warm, airy room and allowed to cure for a few weeks, being turned several times during that period. They

may then be packed in barrels, 125 lbs. to the barrel. The price for the dried fruit averages about 16 to 17 cents a pound.

Brief notes are given on steam-tray driers and air-blast driers, which are adapted more especially for larger establishments than for individual growers.

The field (pp. 462–476).—This portion of the bulletin comprises cultural notes. Black raspberries are recommended for evaporating, the varieties Ohio and Gregg being chiefly grown in New York, the latter being preferred by the author.

The cane should be headed back when from 1½ to 2 ft. high to induce the growth of stout, low laterals. It is advised that the raspberry patch should not be cropped more than 3 or 4 seasons, as after that time there is danger from fungus diseases. The average yearly yield per acre for 3 crops is given as about 1,200 qts., or 300 lbs. of dried product.

The various systems of keeping accounts with berry pickers by means of tags and tickets are discussed, and different forms of checks illustrated.

The berry harvester, a light canvas tray about 3 by 5 ft., into which the berries are knocked by means of a light paddle, the canes being hooked over the tray, is described and figured.

The diseases yellows, red rust or orange rust (*Cæoma nitens*), anthracnose, and root gall are described and remedies given. The destroying of diseased plants is the preferred method.

Notes on small fruits, W. M. MUNSON (*Maine Sta. Bul. 21, 2d ser., pp. 4*).—This is one of a series of bulletins intended to give brief, concise hints on the culture of small fruits and information concerning the more important varieties. This one treats of the strawberry, naming warm, moist, sandy loam as preferable for growing the fruit, and giving directions for the cultivation and winter protection. Matted rows and the placing of boards on each side of the rows of plants to conserve moisture and keep the berries off the ground are recommended. Descriptive notes are given for 28 varieties that have fruited at the station during the past 2 years. Bubach, Bederwood, Crescent, Haverland, Sharpless, Warfield, and Michel are recommended.

Notes on plant breeding, W. M. MUNSON (*Maine Sta. Rpt. 1894, pp. 73–80, pls. 2, figs. 3*).—This consists of general notes on the process of plant breeding, dealing with the main principles and citing some of the results that have been gained by careful work. It is stated that of 107,000 species of flowering plants 4,233 species have been used for food, and that about 300 species are under cultivation to an important extent at the present time. The effects of climate, relationship of species, and individual differences on the breeding of plants are mentioned, and the laws of heredity are considered as playing the most important part. As an illustration of results reached in this field of work the development of a new type of tomato is briefly mentioned. This was produced by crossing the early and productive Currant tomato with the large, vigorous Lorillard variety, with the intention of obtain-

ing smooth, regular fruit of uniform size and early maturity borne in large clusters on a sturdy plant. This end has been attained to a considerable extent, and illustrations are given of the parents and of the resulting hybrid.

Investigations of fruit juices, E. HOTTER (*Ber. Versuchs-u. Samen-Control-Sta. Obstbau Verein Mittelsteiermark, 3 (1895), pp. 1–10*).—This gives tabulated data of investigations of 67 samples of cider expressed from various varieties of apples, 19 of pears, and 9 of cherries, with remarks on some of the conclusions reached. In addition the results are tabulated of the analysis of 21 samples of cider. One variety of apple was found to contain as much as 215 gm. of sugar to the liter of juice, while another contained only 98 gm. The acid content varied from 0.6 gm. to 14 gm., and the tannin from 0.2 gm. to 6 gm. per liter. In the pears the sugar varied from 96.5 gm. to 155 gm., the acid from 1 gm. to 4.25 gm., and the tannin from 0.03 gm. to 0.83 gm. In cherry juice the sugar ranged from 95 gm. to 155 gm., the acid from 3.5 gm. to 5.7 gm., and the tannin from 0.15 gm. to 1.07 gm.

Technical directions are given for determining the amount of tannin in fruit juices. The amount in cider was found to diminish from 15 to 80 per cent within a few days after expression.

The following gives the amount of boric acid found in 100,000 parts of various fresh fruits: Table apples, 0.4 to 1.6 parts; wild apples, 0.17 part; pears, 0.8 to 1.9 parts; medlars, 1.8 parts; and figs, 1.5 parts.

The culture of the garden bean, W. W. TRACY (*Garden and Forest, 9 (1896), No. 429, pp. 194–196*).—Brief notes on the thoughtful selection of varieties and localities.

The castor-oil bean, D. P. DAVENPORT (*Sci. Amer. Suppl., 41 (1896), No. 1062, pp. 16969, 16970*).—Notes on culture and harvesting.

Cauliflowers, W. M. MUNSON (*Maine Sta. Rpt. 1894, pp. 110–119*).—A reprint of Bulletin 10 of the station (E. S. R., 6, p. 51).

Ginger (*Indian Agr., 21 (1896), No. 4, pp. 120, 121*).

Experiment in manuring hops, P. WAGNER (*L'Engrais, 11 (1896), No. 4, pp. 196*).

Fertilizer experiments with hops, KLEIN (*Deut. landw. Presse, 23 (1896), No. 42, p. 369*).

Mushrooms, W. C. BATES (*Amer. Florist, 11 (1896), No. 412, pp. 1051, 1052*).—An abstract of a paper read before the Boston Mycological Club and dealing chiefly with distinctions between the poisonous Amanitas and harmless Agarics.

Mushrooms, J. G. GARDNER (*Amer. Florist, 11 (1896), No. 412, pp. 1050, 1051, fig. 1*).—Directions for growing mushrooms both in greenhouses and in dark pits.

Tomatoes, W. M. MUNSON (*Maine Sta. Rpt. 1894, pp. 112–115*).—A reprint of Bulletin 9 of the station (E. S. R., 6, p. 51).

Growing tomatoes (*Garden and Forest, 9 (1896), No. 425, p. 157*).—A short note on a comparative test of planting tomato seed directly in the field as against plants started under glass. The second method gave twice the yield.

Truffles (Terfâs) of Messata in Tripoli, A. CHATIN (*Compt. Rend., 122 (1896), No. 16, pp. 861–864*).

Vanilla, an article compiled from scientific and commercial sources, W. KREBS (*Pharm. Central Halle, 16 (1895), p. 487; noted in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, p. 532*).—The article deals with culture and trade, vanillin and poisoning from vanilla ices, and methods of preparation.

Espalier apples (*Garden, 49 (1896), No. 1274, p. 283*).—Notes on preferable English varieties for this purpose.

Apricot culture (*Garden, 49 (1896), No. 1274, pp. 283, 284*).—Directions for growing apricots in England.

Apricot culture, A. H. Benson (*Agl. Gaz. N. S. Wales, 7 (1896), Nos. 3, pp. 137–146; 4, pp. 220–232, figs. 10*).

Date cultivation in Antigua (*Indian Agr., 21 (1896), No. 4, p. 135*).

Grape fruit and shaddocks, D. Morris (*Garden and Forest, 11 (1896), No. 412, pp. 163, 164, figs. 4*).—A discussion of these citrus fruits, illustrated from photographs. They are all varieties of *Citrus decumana*, the larger being called pumelows (pomelos) and shaddocks, while the smaller are "forbidden fruit" when globose, and grape fruit when pear-shaped.

Fruit culture in the Himalayas (*Bd. Trade Jour.; Agl. Jour. Cape Colony, 9 (1896), No. 8, pp. 184, 187*).—The climatic conditions are decidedly against the introduction of European and American varieties.

Extremes in tree pruning, E. A. Long (*Amer. Gard., 17 (1896), No. 75, p. 340, figs. 2*).—Argues that overpruning induces rot, while too little pruning does not stimulate a strong growth.

On the repression of gum flow in stone fruit trees (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 58, 59*).—Experiments made from November until October of the following year seemed to show that where pruning is done during the period of vegetative activity, April to August, there will be a greater production of gum in wounds than when practiced later. On this account, where fall transplanting can not be practiced, the trees may be pruned and left until spring for planting.

Treatment of frost-injured fruit trees, L. Schleicher (*Wurt. Wochenbl. Landw., 1896, No. 17, pp. 211, 212*).

Raspberries (*Garden, 49 (1896), No. 1273, pp. 269, 270, fig. 1*).—Cultural directions for English gardeners.

Fruit drying (*Gard. Chron., 19 (1896), No. 490, pp. 607, 608*).—Brief general and statistical remarks, claiming that British dried fruit is superior to that prepared in California.

Some hints to farmers who grow fruits, G. S. Zurn (*Deut. landw. Presse, 23 (1896), Nos. 34, p. 295; 35, p. 308; 36, pp. 314, 315*).

Fruit growing in Kentucky, and notes upon vegetables, C. W. Mathews (*Kentucky Sta. Rpt. 1894, pp. 27–53*).—A reprint of Bulletin 50 of the station (E. S. R., 6, p. 51).

Varieties of fruits, W. M. Munson (*Maine Sta. Rpt. 1894, pp. 135–138*).—A reprint of Bulletin 6 of the station (E. S. R., 5, p. 985).

Culture of grapevines in greenhouses, P. Mouillefert (*Prog. Agr. et Vit., 25 (1896), No. 17, pp. 463–467*).

Resistant vine stocks, H. W. Crabb (*Pacific Wine and Spirit Rev.; Agl. Gaz. N. S. Wales, 7 (1896), No. 3, pp. 157–159*).

Reëstablishment of the vineyards of Soir-et-Cher, H. Blin (*Jour. Agr. Prat., 60 (1896), No. 15, pp. 546–548*).

The condition of the vineyards of the Lower Loire in 1894 (*Bul. Sta. Agron. Loire-Inférieure, 1894, pp. 46–50*).—Brief notes on the acreage and insect enemies of the vineyards in this region. The phylloxera was present, but yielded to treatment with carbon bisulphid.

Ornamental walnut trees, W. Goldring (*Garden, 49 (1896), No. 1273, pp. 278, 279, fig. 1*).—Notes on walnuts as trees for ornamental planting, especially discussing the Persian, black, and California walnuts, and butternut.

Scotch fir (*Garden, 49 (1896), No. 1274, p. 296, fig. 1*).—Illustrated note on this conifer, which is highly recommended for ornamental planting.

The native Cypripediums as forcing plants, J. Dawson (*Amer. Florist, 11 (1896), No. 412, pp. 1018, 1019, figs. 2*).—The writer recommends *C. spectabile*, *C. pubescens*, and *C. acaule* for this purpose.

The dahlia and its culture, H. C. Townsend (*Amer. Gard., 17 (1896), No. 71, pp.

273, 274, figs. 3).—Notes on propagation, culture, and the selection of varieties, with illustrations of some leading sorts.

Trumpet daffodils in the Landes, C. W. DOD (*Gard. Chron., 19 (1896), No. 485, pp. 451, 452*).—Notes on some indigenous patches of *Narcissus maximus* in France, from which the peasants collect and sell the bulbs.

Pot culture of violets, A. MACKAY (*Amer. Florist, 11 (1896), No. 412, p. 1051*).—Brief directions for house growing.

Mulching and top-dressing, R. PARKER (*Garden, 49 (1896), No. 1273, pp. 274, 275*).—A short article showing how this procedure is often valuable in the case of certain vegetables, fruits, and flowers.

Report of the horticulturist, C. W. MATHEWS (*Kentucky Sta. Rpt. 1894, pp. XLVI, XLVII*).—This consists of brief mention of the work carried on by this department during the year, which consisted chiefly of variety tests and the culture of vegetables and small fruits and experiments in training and pruning grapes. In addition 3 new propagating and forcing houses are described. It is intended to pay more attention in future to cultural methods and tests of insecticides and fungicides.

FORESTRY.

Economical designing of timber trestle bridges, A. L. JOHNSON (*U. S. Dept. Agr., Division of Forestry Bul. 12, pp. 57, figs. 7*).—This bulletin is the result of studies of the values of strength developed in the timber test work of this division. Tables are given for safe loads of beams, columns, etc., applicable to the designing of timber structures in general. Suggestions are offered for more economical designing of timber structures, and the hope is expressed that the information given will tend to a more rational use of forest resources. Appended to the bulletin are the opinions of 2 expert bridge engineers upon the statements and conclusions of the author.

Two historic trees (*Forest Leaves, 5 (1896), No. 8, pp. 120, 121, pls. 2*).—Notes and illustrations are given of a bald cypress in Bartram's Garden, Philadelphia, and of a scion of the Penn Treaty elm.

North American trees and their enemies, J. BOOTH (*Die Nordamerikanischen Holzarten und ihre Gegner. Berlin: J. Springer, 1896*).

On the effect of varying amounts of lime and magnesia on the development of conifer trees, O. LOEW and S. HONDA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 6, pp. 378–380, pl. 1*).—Experiments connected with *Cryptomeria japonica, Thuja obtusa,* and *Pinus densiflora* show that lime soil is considered the best for such trees, while magnesia soils are relatively poor. The intrinsic value of lime in the soil is shown even when it is greatly surpassed by the quantity of magnesia in the soil. Lime in soil manifests itself in the production of greatly shortened leaves.

Grafting conifers (*Field, Farm, and Garden, 87 (1896), No. 2256, p. 151*).—A discussion of the process, with recommendation of suitable stocks.

Conifer grafting (*Gard. Chron., 19 (1896), Nos. 484, pp. 432, 433; 485, pp. 463, 464, figs. 2*).—Directions for this process in various conifers, a modified cleft graft being preferred.

The production and rate of increase of Cryptomeria japonica, S. HONDA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 6, pp. 335–377, tables 12*).

American larches, C. W. STRICKLAND (*Gard. Chron., ser. 3, 19 (1896), No. 483, p. 399*).—Brief notes are given of the growth and relative value of American larches in England.

Tree palms of the United States (*Garden and Forest, 9 (1896), No. 425, pp. 151, 152, pl. 1*).

Rate of growth of loblolly pine, A. M. MLODZIANSKY (*Garden and Forest, 9 (1896), No. 419, pp. 92, 93*).

Sowing white pine seed (*Garden and Forest, 9 (1896), No. 424, p. 142*).—A highly successful trial of sowing white pine seed mixed with rye or buckwheat is reported. The seed was mixed at the rate of 2 qts. of the pine seed to enough rye or buckwheat to sow an acre. The trial was made upon poor sandy soil in New England.

Do pine needles grow for more than one season? S. HONDA (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 6, pp. 391, 392*).—From experiments with *Pinus longifolia, P. korainsis,* and *P. densiflora* the author concludes that there is no growth of pine leaves during the second year.

The cultivation of sandalwood in India, L. RICKETTS (*Jour. Bureau Agr. West Australia, 2 (1895), No. 20, pp. 559, 560*).

Sisum (Dalbergia sissoo), P. N. LAHIRI (*Indian Agr., 21 (1896), No. 1, p. 9*).—A valuable timber tree, the method for its propagation and cultivation being given.

Concerning osier cultivation, G. RASSL (*Centbl. ges. Forstw., 22 (1896), No. 3, pp. 137, 138*).

The whahoo, or winged elm, G. NICHOLSON (*Gard. Chron., ser. 3, 19 (1896), No. 485, p. 453, fig. 1*).—Illustrated descriptive notes are given of *Ulmus alata.*

Prunus myrobalana as a hedge plant, R. PARKER (*Garden, 49 (1896), No. 1271, p. 230*).—It is advised for farm hedges, but not liked for gardens, hedges of juniper being recommended for this last purpose.

Hedge row timber, A. C. FORBES (*Gard. Chron., ser. 3, 19 (1896), No. 484, p. 406*). Elm, locust, alder, willows, and poplar are recommended for planting in out-of-the-way places, along fences, etc.

Drill culture in forestry (*Deut. landw. Presse, 23 (1896), No. 27, p. 233*).

Relation of trees to light and shade, B. E. FERNOW (*Forest Leaves, 5 (1896), No. 8, p. 124*).

Injury to forest vegetation by frost during the winter of 1895 (*Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 9-12*).—A report is given of the effect of unusual frost conditions upon forest vegetation. In some districts many indigenous trees were killed by the cold. Many species of eucalyptus and of wattles were destroyed.

Care of woodland, W. A. BUCKHOUT (*Forest Leaves, 5 (1896), No 8, p. 116*).

Concerning forest management, M. BUBERL (*Centbl. ges. Forstw., 22 (1896), No. 3, pp. 101-112*).

The management and protection of forests (*Nature, 53 (1896), No. 1379, pp. 510-515*).—This article is a résumé from the recent works of Schlich, Fisher, and others.

Management and protection of forests, II, D. BRANDIS (*Nature, 53 (1896), No. 1380, pp. 535-540*).

Origin and development of the forest industry in Haute-Savoie, BOIREL (*Ann. Agron., 22 (1896), No. 3, pp. 97-116*).

Forest reservation and water supply (*Forest Leaves, 5 (1896), No. 8, pp. 117, 118*).—A brief account is given of a lecture by J. T. Rothrock upon this subject.

Trees and their rôle in nature, J. G. O. TEPPER (*Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 29-77*).

The need of a forest policy for the Western States, F. T. DU BOIS (*Proc. Amer. Forestry Assoc., 11 (1896), pp. 17-31*).

National forestry legislation, T. C. MC RAE (*Proc. Amer. Forestry Assoc., 11 (1896), pp. 62-64*).

The waste of timber and how to avoid it, A. RUDDER (*Agl. Gaz. N. S. Wales, 7 (1896), No. 1, pp. 13-28, fig. 19*).—Attention is called to the waste of timber in connection with the usual methods of bridge and culvert construction and suggestions are given for preventing such loss. Some of the principal Australian timber trees are described and the general subject of reforestation considered.

The destruction and repair of our natural resources, J. F. LACEY (*Proc. Amer. Forestry Assoc., 11 (1896), pp. 55-61*).

Investigations concerning the technical properties of wood at the forest academy of Eberswald (*Deut. landw. Presse, 23 (1896), No. 19, p. 159*).

Investigations concerning the saw pinching of the more important Japanese timbers, F. KOIDE (*College Agr., Tokyo, Japan, Bul., vol. 2, No. 5, pp. 301–331*).

SEEDS—WEEDS.

Experiments on the vitality of some forage plant seed, W. CARRUTHERS (*Jour. Roy. Agl. Soc. England, ser. 3, 7 (1896), No. 25, pp. 117–119*).—In order to obtain some definite information as to the depreciation in value of seed carried over from year to year, the author tested in 1895 a lot of seed that had been tested previously in the spring of 1893. There are no data to establish the fact that the seed was of the harvest of 1892, although that presumption is probable. The results are interesting in showing the rather rapid loss of vitality of commercial seed due to age.

Vitality of forage plant seed tested in 1893 and 1895.

Kind of seed	Germinating percentage 1893.	Germinating percentage Dec. 1895.	Per cent depreciation in 2½ years.
White clover	98	87	11.23
Lucern	99	87	12.13
Do	98	85	13.27
Trefoil	97	74	21.28
Do	98	41	58.17
Alsike	96	54	43.75
Red clover	100	48	52.00
Timothy	94	75	20.30
Meadow fescue	98	72	26.53
Cocksfoot	96	64	33.33
Do	97	57	41.24
Rye grass	100	64	36.00
Sweet vernal	73	40	45.21
Dogstail grass	89	43	51.69
Do	88	[illegible]	56.82
Hard fescue	97	33	65.98
Do	94	23	75.54
Rough meadow grass	92	14	84.79
Tall fescue	88	9	89.80
Golden oat grass	53	1	98.12
Foxtail	71	1	98.60
Tall fescue	50	0	100.00
Sheep's fescue	86	0	100.00

Report of the seed-control station of Middle Stiermark, E. HOTTER (*Ber. Pomol. Versuchs. und Samen Control Sta. Obstbauvereines Mittelsteiermark, 1894–'95, pp. 11–14*).—A report is given of the activity of the seed-control station during the year ending June 30, 1895. There were tested 346 lots of seed, a gain of 215 over the previous year's work. During the same time 2,126 sacks of seed were tested and sealed, as compared with 603 for the previous year. Most of the seeds were clovers, grass, and beet seed. A table shows the results obtained from examinations made of some of the poorer lots of seed, in which both purity and germinative ability were very low. Samples of clover seed coming from different parts of Styria were examined for dodder, and those coming from Pettau contained 1.3 per cent *Cuscuta epithymum*.

The wild onion, R. L. WATTS (*Tennessee Sta. Bul., Vol. VIII, No. 2, pp. 25–34, figs. 7*).—Illustrated notes are given on the wild onion, *Allium vineale*, in which the plant is described, its distribution noted, and the method of its propagation and dissemination discussed. Experiments were conducted in combating this pernicious weed by plowing it under, by frequent cultivation, mowing, cropping, and shaving the soil. The methods tried, except the last, were not very successful, and this will be given further trial. This method consists of shaving the surface of the soil as often as the green tops present themselves. As a result of one year's work, the author estimates that only about 10 per cent of the original bulbs in the plat have retained their vitality.

Preparation of sugar-beet seed by the Jensen hot-water method, HOLLRUNG (*Ztschr. Rubenz. Ind., 16 (1896), p. 171; abs. in Chem. Ztg., 20 (1896), No. 34, p. 129*).

On the perforation of the seed coats of clover seed, H. RODEWOLD (*Landw. Wochenbl. Schles.-Holst., 46 (1896), No. 10, p. 175*).

The vitality of red clover seed, W. J. BEAL (*Michigan Bd. Agr. Rpt. 1894, pp. 442, 443*).—This is a reprint from *Agl. Sci., 8 (1894), No. 6–9, p. 284* (E. S. R., 6, p. 638).

The vitality of seed buried in the soil, W. J. BEAL (*Michigan Bd. Agr. Rpt. 1894, pp. 411, 412*).—This article is reprinted from *Agl. Sci., 8 (1894), No. 6–9, pp. 283, 284* (E. S. R., 6, p. 639).

On the germination of the cocoanut, L. WITTMACK (*Ber. deut. bot. Ges., 14 (1896), No. 5, pp. 145–150, figs. 2*).

Annual report of the seed control station at Hohenheim, O. KIRCHNER (*Würt. Wochenbl. Landw., 1896, Nos. 14, pp. 193–196; 15, pp. 209–211*).

Report of the seed control station at Vienna, Austria, 1894–'95, T. RITTER VON WEINZIERL (*Chem. Ztg., 20 (1896), No. 27, pp. 240, 241*).

Catchflies, F. L. HARVEY (*Maine Sta. Rpt. 1894, pp. 97–100, fig. 1*).—Notes are given on two catchflies, *Silene noctiflora* and *S. dichotoma*, the latter being reported as a troublesome weed.

Sisymbrium altissimum, J. W. MACOUN (*Torrey Bul., 23 (1896), No. 4, p. 152*).—This weed, first recorded in Canada in 1885, has spread rapidly, and is now considered the "worst tumbleweed" of northwestern Canada.

On the eradication of weeds, RETTICH (*Landw. Ann. meckl. patr. Ver.; Landw. Wochenbl. Schles.-Holst., 46 (1896), No. 10, pp. 174–176*).

Oklahoma weeds, J. C. NEAL (*Oklahoma Sta. Bul. 17, pp. 40, plates 9, figs. 7*).—Popular descriptive notes are given on an extensive list of weeds, together with suggested methods for their eradication. The weeds are classed as aggressive, timid, occasional, and those to be expected, about 75 species in all being described.

DISEASES OF PLANTS.

On potato rot and its prevention, especially by copper fungicides, W. M. SCHÖYEN (*Tidskr. norske Landbr., 3 (1896), pp. 1–21*).—Culture experiments were conducted in 3 different localities with Prima Donna, Yellow Rose, and Magnum Bonum potatoes. The potatoes were grown in plats containing 36 to 75 square meters, 3 plats being left untreated in each case, and the rest treated with "fostite," copper and sulphur powder, and Bordeaux mixture. The treatment with fungicides was made once, twice, or three times in case of different plats, with results as shown in table on page 873.

Experiments with fungicides for potatoes.

[Calculated yields per 10 are= 0.247 acre.]

	Prima Donna.			Yellow Rose.			Magnum Bonum		
	Sound potatoes	Diseased potatoes	Total yield	Sound potatoes.	Diseased potatoes.	Total yield	Sound potatoes	Diseased potatoes.	Total yield.
	Kg	*Kg.*	*Kg*	*Kg*	*Kg*	*Kg.*	*Kg.*	*Kg*	*Kg.*
Not treated (average of three plats)	1,455	1,457	2,912	2,055	288	2,343	[1]2,319	[1]56	[1]2,375
Fostite:									
Treated once	1,562	1,225	2,787	2,335	187	2,522	2,474	49	2,523
Treated twice	1,688	1,087	2,775	2,361	232	2,593	2,737	83	2,820
Treated three times	1,838	837	2,675	2,367	155	2,522	......	......	......
Copper and sulphur powder:									
Treated once	2,037	1,125	3,162	2,458	219	2,677	2,805	14	2,819
Treated twice	2,000	1,087	3,087	2,478	122	2,600	3,098	28	3,126
Treated three times	2,825	537	3,362	2,632	144	2,776	......	......	......
Bordeaux mixture:									
Treated once	2,025	1,250	3,275	2,542	271	2,813	2,777	28	2,805
Treated twice	2,537	663	3,200	2,968	135	3,103	3,180	28	3,208
Treated three times	2,775	425	3,200	3,187	187	3,374	......	......	......

[1] One plat

The fostite gave decidedly poorer results than the 2 other fungicides applied, while there was no marked difference between these latter. The author estimates that the following quantities are required per 10 are: Fostite, first treatment 3 kg., later treatments 5 kg. each; copper and sulphur powder, first treatment 4 kg., later treatments 6 kg. each; Bordeaux mixture, 2.8 kg. for each treatment.—F. W. WOLL.

A new potato disease, F. FAUTREY (*Rev. Mycol., 18 (1896), No. 69, pp. 11, 12, figs. 2*).—During the summer of 1895 a disease was discovered in Auxios in the department of Cote d'Or, France. In fields where it appeared, at least one third of the plants were attacked and destroyed. When attacked, the vines became wilted, the leaves turned yellow, and by the middle of summer dried up and were destroyed, the host never flowering. The diseased vines are readily pulled up and no tubers are formed. The author dug up many diseased vines and found nearly every one to have sprung from a cutting and not an entire tuber. The cut surfaces were covered by the mycelium of various fungi, on which account the author is led to think that cutting the tubers may be a source of infection for this and perhaps many other diseases. After consulting with various mycologists, the author has given to this new fungus the provisional name *Entorrhiza solani.* The rotted remnants of the stems are filled with spherical, subpyriform, oval spores, the most common form being the spherical ones, which are about 10 μ in diameter. When cultivated in an aqueous solution of gelatin for about 36 hours at 20 to 22° C., germination of the spores begins.

The author recommends that as a preventive measure whole potatoes be planted.

The apple rots, L. F. KINNEY (*Rhode Island Sta. Rpt. 1894, pp.*

192–198, figs. 8).—The author has made a study by means of cultures, inoculations, etc., of the rots liable to attack the ripe or nearly ripe fruit of the apple, and illustrated notes are given of the brown rot (*Sphæropsis malorum*), the ripe or bitter rot (*Glœosporium fructigenum*), and the blue mold (*Penicillium glaucum*). It is stated that a pomace fly (*Drosaphila ampelophila*) is an important agent in the dissemination of the spores of these fungi.

Some experiments with fungicides on peach foliage, S. M. BAIN (*Tennessee Sta. Bul., Vol. VIII, No. 3, pp. 35–40*).—The author records the results of a series of experiments with different fungicides upon peach foliage. Formulas and directions for the preparation of the 28 mixtures used are given. The experiments were conducted upon 10 healthy trees. For each fungicide 10 branches bearing 10 leaves each were chosen and carefully sprayed, applications being made June 20 and 21, and July 5 and 6.

The results of the applications are given in the following table:

Effect of fungicides upon peach foliage.

	Leaves remaining			
	June 29	July 8 and 9.	July 18.	September 25
1 Neutral Bordeaux	98	20	10	0
2. Bordeaux with London purple	97	18	0	0
3. Bordeaux treated with carbon dioxid	100	19	0	0
4. Bordeaux treated with carbon dioxid, then mixed with London purple	99	10	0	0
5. Bordeaux and London purple treated with carbon dioxid	94	17	1	0
6. Copper hydroxid	99	26	0	0
7. Copper dicupric hydroxid	95	20	0	0
8. Copper carbonate	88	2	0	0
9. Ammoniacal copper carbonate	97	45	12	3
10 Ammoniacal copper carbonate with London purple	83	14	0	0
11. Bordeaux made with excess of copper sulphate	94	13	0	0
12. Bordeaux followed by milk of lime	100	84	52	8
13. Bordeaux treated with carbon dioxid and washed	98	10	0	0
14. Washed Bordeaux	94	16	0	0
15. Alkaline Bordeaux	100	98	95	51
16. Basic copper sulphate	95	6	0	0
18. Calcium sulphate	100	100	98	41
19. Calcium sulphate and calcium carbonate	100	100	100	38
20 Calcium sulphate and calcium hydroxid	100	100	100	82
22. Milk of lime	97	96	96	30
23. Copper hydroxid and lime	100	98	81	3
24. Copper hydroxid and calcium sulphate	89	9	0	0
25 Copper hydroxid with sulphate and hydroxid of lime	99	96	78	0
26 Copper hydroxid with sulphate hydroxid, and carbonate of lime	97	82	61	0
29. Bordeaux with sodium carbonate	100	28	0	0
30 Quadruple strength Bordeaux	100	92	37	0
31. Bordeaux treated with a current of air	90	15	0	0
36 Calcium carbonate	100	99	96	38
Control	99	98	91	50

From the results given in the bulletin the author suggests the following formula for use upon peach foliage: Copper sulphate 6 lbs., quicklime 8 lbs., and water 50 gals.

The hot-air treatment for stinking smut or bunt, N. A. COBB (*Agl. Gaz. N. S. Wales, 7 (1896), No. 2, pp. 82, 83*).—A report is given of experiments with hot air as a preventive of stinking smut of wheat. Four lots of wheat were subjected to dry heat as follows: (1) Hot air

150° F. for 3 minutes, (2) at 200° for 1 minute, (3) at 200° for 3 minutes, and (4) at 300° for 1 minute, comparisons being made with wheat treated with hot water at 135° for 15 minutes, and with untreated seed. The seed wheat was from an infected crop and in addition was thoroughly mixed with smut spores before the treatments were given. The results obtained, which indicate that the treatment is unfavorable, were as follows:

Effect of hot-air treatment for the prevention of stinking smut in wheat.

Treatment.	Germination	Smutted plants.
	Per cent.	*Per cent.*
No treatment	75	86
Hot water, 135°, 15 minutes	67	2
Hot air, 150°, 3 minutes	20	20
Hot air, 200°, 1 minute	64	44
Hot air, 200°, 3 minutes	0	....
Hot air, 300°, 1 minute	28	64

It is thought a lower temperature for a longer time might possibly give more favorable results.

Report of the botanist, F. L. HARVEY (*Maine Sta. Rpt. 1894, pp. 81-103, figs. 5*).—A list is given of the more important plants examined at the station during the year, and notes are appended showing their range and habit. Illustrated notes are given, together with suggested remedies for quince rust (*Rœstelia aurantiaca*), oat diseases due to *Helminthosporium inconspicuum britannicum* and *Cladosporium herbarum*, and the potato scab (*Oospora scabies*). The Helminthosporium was determined by Mr. J. B. Ellis, and it is thought the variety is here reported in this country for the first time.

Notes are also given on 2 of the catchflies (see p. 872).

Concerning the cause of the so-called dry rot of the potato, C. WEHMER (*Ber. deut. Bot. Ges., 14 (1896), No. 3, pp. 101-107, fig. 3*).—The cause of the dry rot of potatoes is attributed to *Fusarium solani*.

A new scab parasite of the potato tuber, K. SCHILBERSZKY (*Ber. deut. bot. Ges., 14 (1896), No. 1, pp. 36, 37*).—A new parasite of the potato is described under the name *Chrysophlyctis endobiotica*.

The fungus diseases of potatoes, C. WEHMER (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 8, pp. 261-270*).—A résumé of the literature of the past 3 years is given.

On the penetration of Rhizoctonia violacea into the roots of sugar beets and lucern, E. PRILLIEUX (*Bul. Soc. Bot. France, ser. 3, 43 (1896), No. 1-2, pp. 9-11*).

Fungus parasites of the apple and pear, L. F. KINNEY (*Rhode Island Sta. Rpt. 1894, pp. 184-192, figs. 11*).—Illustrated notes are given of apple and pear scab (*Fusicladium dendriticum*), apple rust (*Gymnosporium macropus*), leaf spot of the apple and pear (*Phyllosticta pyrina*), and leaf blight and cracking of the pear (*Entomosporium maculatum*), together with remedies and treatment suggested for their repression.

The black knot of the wild cherry, B. D. HALSTED (*Forester, 2 (1896), No. 3, pp. 39, 40*).—Notes are given on the black knot fungus, *Plowrightia morbosa*.

Taphrina acerina, n. sp., A. G. ELIASSON (*Bihang. k. Svensk Vetensk. Akad. Handlingar, 20 (1895), No. 4, pp. 7, pl. 1; abs. in Bot. Centbl., 66 (1896), No. 1, p. 13*).—This new species is described as parasitic on the leaves of *Acer platanoides*.

Some diseases of conifers, A. C. FORBES (*Gard. Chron., ser. 3, 19 (1896), No. 488,*

pp. 553, 554).—A review is given of some diseases of *Thuya gigantea* due to *Pestalozzia funerea* and of *Pseudotsuga douglasi* due to *Phoma abietina*.

The larch disease, GLASNEVIN (*Gard. Chron., ser. 3, 19 (1896), No. 489, p. 584*).—This disease is reported as occurring sparingly in Ireland.

Some new or little known fungi growing on trees, P. VUILLEMIN (*Bul. Soc. Mycol. France, 12 (1896), No. 2, pp. 33–44*).—*Toxosporium abietinum, Pestalozzia mycophaga*, and *Chætophoma oleacina* are described as new species.

Concerning some tree organisms, F. LUDWIG (*Rev. Mycol., 18 (1896), No. 70, pp. 45–57*).—Notes are given on *Endomyces magnusii, Saccharomyces ludwigii, Leuconostoc lagerheimi, Torula monilioides*, etc.

Eel worms, F. CRANEFIELD (*Amer. Florist, 11 (1896), No. 412, pp. 1045, 1046, figs. 2*).—A discussion of the attacks of nematodes on legumes, the writer believing that the normal root tubercles are frequently mistaken for root galls.

The influence of nematode injuries on the composition of sugar beets (*Neue Ztschr. Rübenz. Ind., 36 (1896), No. 17, pp. 181, 182*).

Concerning potato nematodes, FRANK (*Ztschr. Spiritus Industrie, 19 (1896), No. 17, p. 136*).

On the value of copper sulphate for the prevention of grain rusts, F. NOACK (*Ztschr. landw. Ver. Hessen, 1896, No. 10, pp. 85–87*).

Combined treatment for mildew and oïdium, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), pp. 255–258*).

Report of the horticultural division, L. F. KINNEY (*Rhode Island Sta. Rpt. 1894, pp. 183, 184*).—Brief notes are given of coöperative tests for the prevention of fungus diseases and insects. During the year 163 lots of plants were distributed from the station and 38 samples of seeds examined and tested. Studies were also made of the fungi causing apple rots.

The potato rot and strawsonite, G. BALFOUR (*Gard. Chron., ser. 3, 19 (1896), No. 486, p. 493*).—A brief statement is given of the successful use of strawsonite and other fungicides for the repression of potato rot in Ireland in 1895.

On the spraying of grapes with copper solutions, NESSLER (*Wochenbl. landw. Vereins in Grossherz. Baden; Deut. landw. Presse, 23 (1896), No. 42, p. 369*).

On the treatment of grape anthracnose, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 17, pp. 419, 470*).

Preliminary report on attempts at combating Peronospora and Cochylis, A. BERLESE (*Bol. entom. agrar. e pat. veg., 2 (1895), pp. 107–110; abs. in Bot. Centbl., 66 (1896), No. 1, p. 39*).—A report is given of the successful use of Bordeaux mixture and "Rubin" for the repression of *Peronospora viticola* and *Cochylis ambiguella*.

Trial of new remedies against black rot, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 10, pp. 253–255*).

The treatment of black rot, C. ABADIE and L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 12, pp. 313–317, pl. 1*).

Experiments on the treatment of black rot, E. MARRE (*Prog. Agr. et Vit., 25 (1896), No. 16, pp. 425–439, pl. 1*).—A summary is given of results obtained by the author in a series of experiments.

On the treatment of fungus diseases, L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 18, pp. 477, 478*).

Spraying experiments, W. M. MUNSON (*Maine Sta. Rpt. 1894, pp. 138–142, figs. 2*).—A reprint of Bulletin 8 of the station (E. S. R., 5, p. 1077).

Spraying formulas and applications, G. MCCARTHY (*North Carolina Sta. Special Bul. 33, p. 1, figs. 2*).—This bulletin, which is in the nature of a poster, contains figures of spraying apparatus, formulas for fungicides and insecticides, and a calendar showing when and how to combat fungus and insect injuries to fruits and vegetables.

Fungicides, S. M. BAIN (*Tennessee Sta. Bul., Vol. VIII, No. 1, pp. 18, 19*).—A brief discussion of the value and methods of applying fungicides. Directions are given

for compounding Bordeaux mixture, alkaline Bordeaux, copper sulphate solution, and ammoniacal copper carbonate.

On the diseases of agricultural plants, fruit, and forest trees due to vegetable parasites (*Maladies des plantes agricoles et des arbres fruitieres et forestieres, causées par des parasites végétaux*), E. PRILLIEUX (*Paris: Firmin-Didot, Bib. Enseign. Agr., 1896.*

ENTOMOLOGY.

The botflies of the horse, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. XXVII–XXXIV, figs. 2*).—This consists mainly of illustrated descriptive and life-history notes on *Gastrophilus equi* and *G. nasalis.* Their methods of oviposition are described and discussed, the former species laying its eggs upon the body and legs, while the latter oviposits under the horse's chin. The author is inclined to believe that the eggs will not hatch unless they are moistened, either by the horse's tongue or some other means. Figures are given of the tarsi and eggs of these 2 flies, which are the species commonly met with in Kentucky.

In addition a synoptical key is given to the species *G. equi, G. nasalis, G. hæmorrhoidalis,* and *G. pecorum,* and brief descriptions of each appended.

The chinch bug, C. E. CHAMBLISS (*Tennessee Sta. Bul., Vol. VIII, No. 1, pp. 11–55, figs. 8*).—A popular bulletin on this insect, with a history of its presence within the State. It was first noticed in Rutherford County in 1868, and since that time has been present every year, but only injuriously so in 1874, 1885, 1888, 1890, and 1895. At present it exists in the northwestern corner and in the center of the State, 8 counties in all being infested. The crops of corn and millet have suffered more than any others, although wheat and sorghum have also been damaged. The abundance of the pest is believed to have been due to the gradually increasing dry weather since 1892. A map is given showing the sections of the State infested, and the history of the species in the United States is briefly outlined. Illustrated notes on the appearance, life history, natural enemies, and diseases are given. As preventive and remedial measures the following are recommended: Clean cultivation, irrigation, rotation of crops, ditches and furrows, spraying with kerosene emulsion, and infection with the Sporotrichum disease. Brief notes are given on the experiments with Sporotrichum, which were not entirely satisfactory in the infection boxes, although in wet places in the fields the insects were killed by the fungus.

The bean root louse, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. XXII–XXVI, figs. 2*).—This consists of illustrated notes on the life history and habits of *Tychea phaseoli,* which attacks the root stalks of beans in gardens about Lexington and inflicts considerable damage. The systematic position of the aphid is discussed and a technical description of the young and adults given. From 15 to 20 of the aphides are attached to every root stalk, which soon becomes discolored and shriveled and the plants dwarfed. The insects were found to be

attended by a small brown ant (*Lasius* sp.). The application of pyrethrum, sulphate of potash, and phosphate of potash to the bases of the plants was made, but with no good results. Scattering ground-up tobacco stems along the furrows where the beans were planted and watering with a strong decoction of tobacco stems was found to destroy the insects and stimulate the growth of the plants, and is recommended as a promising remedy.

A plum twig gall produced by a mite, H. GARMAN (*Kentucky Sta. Rpt. 1891, pp. XX–XXII, fig. 1*).—This consists of illustrated notes on a morbid growth about the ends of plum twigs. It was found to consist of small, brown, nodular galls growing out from twigs at the bases of terminal buds and dwarfing the growth resulting from the buds. As many as 15 galls may be in a single cluster. The size is from 0.67 to 1.5 mm. in diameter, with a height of about the same. The surface of the recently developed galls is smooth, bearing a small pit, which marks an opening into the interior. As the galls become old they blacken, wrinkle, and the skin breaks. It was found that the galls were produced by the mite *Phytoptus phlœocoptes*, which has probably been brought into the United States on imported trees. The galls are in some cases occupied by a large number of the mites. As a remedy, pruning and burning infested twigs during the winter is suggested, combined with spring spraying with the following mixture: Flour of sulphur 1 lb., fresh slacked lime 2 lbs., and water 4 gal. The mixture should be boiled and then applied by means of some efficient spraying apparatus.

An important elm insect, F. H. HILLMAN (*Nevada Sta. Bul. 28, pp. 8*).—This bulletin is issued as a preliminary report upon the elm bark louse (*Gossyparia ulmi*), which has made its appearance on elms in Carson City, where numbers of these trees are being rapidly killed by the invasion. The white elms (*Ulmus americana*) suffer most from the attack, although the cork elms (*U. racemosa*) are also damaged. The appearance, life history, and treatment of the pest are described. The young are hatched in June and July and migrate to the leaves until August, when they return to the branches for hibernation, to become active again in the spring, at which time the males emerge from their cocoons and mate with the permanently fixed females.

Experiments with various remedies indicate that spraying with kerosene emulsion and whale-oil soap destroys from 60 to 80 per cent of the lice. Further study of the habits of the insect to determine the most vulnerable period in its life history is regarded as necessary.

Insects injurious to corn, H. E. WEED (*Mississippi Sta. Bul. 36, pp. 117–159, figs. 11*).—This is a popular compiled bulletin containing illustrated, descriptive, life history, and remedial notes on the black weevil (*Calandra oryzæ*), chinch bug (*Blissus leucopterus*), corn worm (*Heliothis armigera*), Southern grass worm (*Laphrygma frugiperda*), Southern corn root worm (*Diabrotica 12 punctata*), corn billbug (*Sphenophorus* spp.), cutworms, ligyrus stalk beetle (*Ligyrus gibbosus*), euphoria

corn beetle (*Euphoria sepulchralis*), wireworms, corn aphis, and stalk borers. The most approved and efficient remedies for each species are noted, plowing under being recommended in nearly every instance. In the case of an invasion of chinch bugs, distribution of individuals infected with Sporotrichum produced favorable results in destroying the pest.

Notions about the spraying of trees, with remarks on the cankerworm, L. H. BAILEY (*New York Cornell Sta. Bul. 101, pp. 183–502, figs. 7*).—This bulletin popularly discusses the principles and advantages of spraying trees, particularly as treatment for the cankerworm. By a systematic and judicious application of sprays injury from insects and fungi can be stopped at the beginning, and so practically the invasion avoided. In the author's opinion spraying is of some value every year upon apples, pears, plums, and quinces, but the spraying must be done thoroughly.

Illustrations and descriptions are given of some efficient forms of spraying outfits. It is believed to be of advantage to prepare stock solutions, especially for Bordeaux mixture, instead of making up each lot in the quantity required at the time of spraying. In general, for treatment against the two chief enemies, the apple scab and codling moth, it is advised that 2 sprayings be given with a combination of Bordeaux mixture and Paris green, the first just as the fruit buds open and the second as the last blossoms fall.

The sulphureted hydrogen test for soluble arsenic in the Paris green solution is recommended and described. Testing the solubility of Paris green in ammonia is mentioned as a means of determining its purity.

Details are given of experiments to determine what becomes of arsenic when it falls upon the soil in the spraying of trees. The experiments showed that on sandy soil Paris green applied to the surface in May had penetrated but 3 in. by October; on black clay loam, 7 in., the greater depth being due to the rain carrying the poison down worm burrows and channels produced by roots. The conclusion is that arsenites do not leach from the soil, but are mainly washed down to a slight extent by the mechanical action of the rain.

Notes are given on experiments in spraying with various insecticides an orchard that was seriously infested with cankerworms (*Paleacrita vernata*). Paris green and London purple, with and without lime, in different strengths, and two strengths of arsenate of lead mixture were employed. Satisfactory results were obtained, the best being given by a mixture of 1 lb. of Paris green to 200 gals. of water, to which a little lime was added to prevent injury to the foliage. As the infestation was a severe one, however, the trees showed traces of injury throughout the summer.

Brief mention is made of the life history and habits of the cankerworm and the efficiency of the above insecticide is urged.

Report of entomologist, F. L. HARVEY (*Maine Sta. Rpt. 1891, pp.*

83–85, 88, 89, 104–123, figs. 8).—This comprises notes on the following insects that have attracted attention in the State during the year: Snow flea (*Achorutes nivicola*), silver fish (*Lepisma sacharina*), ring-banded soldier bug (*Perillus circumcinctus*), elm tree bark louse (*Lecanium caryæ canadense*), gooseberry plant louse (*Myzus ribis*), oblique-banded leaf roller (*Cacœcia rosaceana*), cecropia emperor moth (*Platysamia cecropia*), chinch bug (*Blissus leucopterus*), buffalo carpet beetle (*Anthrenus scrophulariæ*), oak bark weevil (*Magdalis olyra*) and fall cankerworm (*Anisopteryx pometaria*). The elm tree bark louse (*Lecanium caryæ canadense*) is described as a new variety by T. D. A. Cockerell. It was found in both Maine and Canada, where a number of elm trees were badly infested, and where the pest seems to be increasing. The chinch bug was found in a small area. The chief damage was done to hay and grass lands, although corn was injured to a small extent. Spraying infested patches with kerosene emulsion as soon as they are observed, plowing and rolling badly infested fields as soon as possible, or burning over the land, and rotation of crops with clean farming, are recommended. Descriptive and life history notes are given of the buffalo carpet beetle, and spraying with benzin is recommended.

The bees of the genus Perdita, T. D. A. COCKERELL (*Proc. Phil. Acad. Sci. 1896, I, pp. 25–107*).—Technical notes on many species.

Beehives and their construction, A. GALE (*Agl. Gaz. N. S. Wales, 7 (1896), No. 3, pp. 163–168, figs. 6*).

The wintering of bees, K. WOZELKA (*Deut. landw. Presse, 23 (1896), No. 33, pp. 286, 287, figs. 2*).

Sericulture, J. J. SCHMIDT (*Jour. Bur. Agr. Adelaide, Australia, 8 (1896), No. 8, pp. 149–152*).

A study of the industrial qualities of the cocoon of Bombyx mori in 1895, J. RAULIN (*Ann. Sci. Agron., ser. 2, 1896, I, No. 2, pp. 301–310*).

Mallophaga of North American birds, V. L. KELLOGG (*Zool. Anz., 19 (1896), No. 499, pp. 121–123*).—This compares American and European species, and treats of the isolation and migration of species.

The Mallophaga, V. L. KELLOGG (*Psyche, 7 (1896), No. 241, pp. 375–379*).—This contains tables of subfamilies and genera.

Habits of Limosina sacra, a muscid fly; phenomena of mutual transportation among articulates; the origins of parasitism in dipterous insects, P. LESNE (*Bul. Soc. Ent. France, 1896, pp. 162–166*).

Development of the larva of Œstrus, RUSER (*Ztschr. Fleisch- und Milchhyg., 6 (1896), No. 7, pp. 127–129*).

The cecidomyid of oats, P. MARCHAL (*Rev. Sci. Nat. appl., 42 (1895), No. 12, pp. 551, 552*).—*Cecidomyia avenæ* is described as new.

The Cattleya fly, P. SORAUER (*Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 114–116*).—Remarks on the injury done to orchids in Germany in 1894 by *Isosoma orchidarum*.

Life histories of Australian coleoptera, III, W. W. FROGGATT (*Proc. Linn. Soc. N. S. Wales, 10 (1896), pp. 325–330*).—Notes on the appearance and habits of 14 species injurious to economic vegetation.

Destructive locusts in Kentucky, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. 7–22, figs. 2*).—A reprint from Bulletin 49 of the station (E. S. R., 5, p. 1079).

Invasion and depredation by two species of locusts in Cape Colony in 1896

(*Agl. Jour. Cape Colony, 9 (1896), No. 5, pp. 101–104, 120, 122, 123*).—Numerous reports from various localities.

The breeding habits of Periplaneta orientalis, C. F. SEISS (*Ent. News, 7 (1896), No. 5, pp. 148–150*).—An author's abstract of a long paper on the life history of the cockroach

Monograph of the genus Synergus, C. P. GILLETTE (*Trans. Amer. Ent. Soc., 23 (1896), pp. 85–100*).

The codling moth in Tasmania, W. C. GRASBY (*Garden and Field, 21 (1896), No. 10, pp. 236, 237*).—Brief notes, stating that the pest is being kept down, and citing the laws in regard to it.

Pieris rapæ and Agraulis vanillæ, W. G. WRIGHT (*Canadian Ent., 28 (1896), No. 4, p. 102*).—This gives the dates of the first appearance of Pieris in southern California, and states that *Agraulis vanillæ* was brought by the Southern Pacific Railroad to southern California.

The fight against Ocneria dispar in the United States (*Ann. Sci. Agron., ser. 2, 1896, I, No. 2, pp. 276–290, pl. 1*).

On the best method of exterminating the tussock moth (Orgyia leucostigma), H. SKINNER and W. J. FOX (*Proc. Acad. Nat. Sci. Philadelphia, 1896, pp. 12–14*).

Aspidiotus ficus received from Japan on leaf of Aspidistra, T. D. A. COCKERELL (*Garden and Forest, 9 (1896), No. 429, p. 198*).

The euonymus scale in Japan, T. D. A. COCKERELL (*Garden and Forest, 9 (1896), No. 429, p. 128*).

The scale insect of Robinia, K. SAJÓ (*Forstl. naturw. Ztschr., 5 (1896), No. 3, pp. 81–89, fig. 1*).—Illustrated descriptive and life history notes on *Lecanium robiniæ*, which attacks *Robinia hispida* in Hungary.

The orange mussel scale, C. FULLER (*Agl. Gaz. N. S. Wales, 7 (1896), No. 3, pp. 161, 162, pl. 1*).

Margarodes vitium, V. MAYET (*Agl. Jour. Cape Colony, 9 (1896), No. 7, pp. 159–161*).—Description and remedial treatment of this Chilean vine enemy.

A monograph of insects injurious to sugar cane, and their parasites, D'EMMEREZ DE CHARMOY (*Rev. Agr. Ile Maurice, 9 (1895), No. 12, pp. 294–296*).

Contribution to the knowledge of the insects attacking the roots of sugar cane, V, J. D. KOBUS (*Med. Proefsta. East Java, No. 20, n. ser., pp. 6, pl. 1*).—Descriptive and life history notes on the butterfly *Discophora celinde*.

The bud worm of tobacco, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. 23, 24*).—A reprint from Bulletin 49 of the station (E. S. R., 5, p. 1079).

Some insect enemies of asparagus, G. RÖRIG (*Deut. landw. Presse, 23 (1896), No. 32, p. 281, pl. 1*).—Notes on the asparagus beetle and asparagus fly, with colored illustrations.

Insects injurious to apples, P. BROCCHI (*Jour. Agr. Prat., 60 (1896), No. 14, pp. 499–501, pl. 1*).

Insects attacking plum trees, V. MAYET (*Prog. Agr. et Vit., 25 (1896), No. 18, pp. 492–496*).

Preliminary notes on five new species of scale insects, W. G. JOHNSON (*Ent. News, 7 (1896), No. 5, pp. 150–152*).—Short characterizations of *Chionaspis americana, Aspidiotus forbesi, A. comstocki, A. ulmi*, and *A. æsculi*.

On the life history of the gooseberry mite and its distribution in Germany, F. THOMAS (*Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 80–84*).—Notes on a new species of Bryobia, *B. ribis*, and its injury to gooseberries.

Report of the Phylloxera Commission of Cape Colony for 1895 (*Agl. Jour. Cape Colony, 9 (1896), No. 5, pp. 106–108*).—It is considered that the quarantine system is entirely useless, and that inspectors are no longer necessary. Planting resistant American vines is regarded as the only remedy.

Insects attacking the grape, R. BRUNET (*Jour. Agr. Prat., 60 (1896), I, No. 19, pp. 678–685, pl. 1, figs. 2*).—Pyralis, Altica, Anomala, and Vesperus are the genera considered.

Insect pests of conifers, D. ROBERTSON (*Gard. Chron., ser. 3, 19 (1896), No. 486, pp. 486, 487*).—Notes are given of *Sirex gigas* and other insects.

A disease of linden leaves, R. THIELE (*Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 78, 79*).—Note on a species of Diplosis, probably *D. tiliarum*, producing galls on the blossoms of *Tilia parvifolia*.

Insects injurious to horticulture, W. G. JOHNSON (*Extr. from Trans. Hort. Soc. Central Illinois, 29 (1895), pp. 18, figs. 24*).—An illustrated popular article on the more common and important predaceous and parasitic insects.

A list of night-flying moths from Kentucky, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. XXXV-XL*).—This consists of a list of 131 species collected chiefly at Lexington, accompanied by dates of taking and notes of their relative abundance.

Of bookworms, W. AUSTIN (*Nation, 62 (1896), No. 1607, pp. 305, 306*).—Mentions the finding of the larvæ of Ptinidæ in a book in the Cornell University Library, and cites the literature of Anobiids attacking books.

Practical entomology, J. FLETCHER (*Trans. Roy. Soc. Canada, 1 (1895), No 1, pp. 3-15*).—This is the president's address, read before the section of geological and biological science, and discussing economic entomology in a general way, treating of the history of the development, the methods of study and control of injurious insects, and the value of coöperation.

Agricultural entomological report, P. H. FOULKES (*Reading [Engl.] University Extension Coll. Rpt. 1895, pp. 33-36*).—Notes on various insects that were injurious during the year in Berkshire, Hampshire, and Oxfordshire, the turnip, flea beetle (*Haltica nemorum*), frit fly (*Oscinis frit*), crane fly (*Tipula oleracea*), rose chafer (*Phyllopertha horticola*), turnip gall weevil (*Centorhynchus sulcicollis*), and mangel fly (*Anthomyia beta*) being chiefly mentioned.

The internal mechanism of the genital apparatus of male orthopters, A. FÉNARD (*Compt. Rend., 122 (1896), No. 16, pp. 894, 895*).

The internal mechanism of the genital apparatus of female orthopters, A. FÉNARD (*Compt. Rend., 122 (1896), No. 20, pp. 1137-1139*).

Dipping vat for sheep, J. A. CRAIG (*Breeders' Gaz., 29 (1896), No. 22, pp. 402, figs. 2*).

Dipping and dressing cattle for ticks in Queensland (*Agl. Jour. Cape Colony, 9 (1896), No. 8, pp. 186, 187*).

An automatic locust catcher (*Agl. Ledger, 1895, No. 15, pp. 6, figs. 4; from Selskaya khozaylu*).

On the economic preparation of tobacco infusion, H. DEVAUX (*Prog. Agr. et Vit., 25 (1896), No. 17, pp. 450, 451*).

Spraying for codling moth, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. 117-125, fig. 1*).—A reprint from Bulletin 53 of the station (E. S. R., 6, p. 1006).

On washes and sprays for combating plant lice and allied insects, E. FLEISCHER (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 13-17*).

Arsenic salts as insecticides, SAJÓ (*Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 106-109*).—Remarks on an article on Paris green by C. L. Marlatt in *Insect Life, vol. 7*.

The use of arsenites on tobacco, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. 125-143, figs. 6*).—A reprint from Bulletin 53 of the station (E. S. R., 6, p. 1006).

The use of bisulphid of carbon and hydrocyanic-acid gas on low-growing plants, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. 144-150, fig. 1*).—A reprint from Bulletin 53 of the station (E. S. R., 6, p. 1006).

Inspection of Paris green in Louisiana, W. C. STUBBS (*Louisiana Stas. Bul. 39, 2d ser., pp. 1431-1434*).—The text of the State law regulating the sale and purity of Paris green in the State is given, with analyses of 2 samples of this material examined under the provisions of the law.

A novel method of fumigating, C. L. REYNOLDS (*Amer. Florist, 11 (1896), No. 412, p. 1049*).—This cites an experiment in fumigating a greenhouse of coleus

infested with orthezia with hydrocyanic acid gas. The insects were killed, while the plants escaped injury.

Insecticides, C. E. CHAMBLISS (*Tennessee Sta. Bul., Vol. VIII, No. 1, pp. 14–17*).—This briefly discusses the action of insecticides upon biting and sucking insects and gives directions for the application of Paris green, London purple, kerosene, and "Raupenleim." Formulas are given for preparing kerosene and soap emulsion and kerosene and milk emulsion, as well as directions for applying kerosene and water in a mechanical mixture.

Spraying apparatus, R. L. WATTS (*Tennessee Sta. Bul., Vol. VIII, No. 1, pp. 3–18, figs. 15*).—This is designed to give information on the working of various styles of spraying apparatus. Bucket pumps, knapsack sprayers, barrel sprayers, and power machines are described and the best kinds illustrated. In addition, remarks are made on agitators, hose, extension rods, nozzles, and powder machines. The machines with which the best results have been achieved at the station are mentioned and recommended.

Spraying calendar, C. E. CHAMBLISS and S. M. BAIN (*Tennessee Sta. Bul., Vol. VIII, No. 1, pp. 20–24*).—This consists of tabulated directions for the application of various remedies against insect and fungus pests of different fruits and vegetables, the applications being classified under the heads of the plants to be protected.

Remedies for the Hessian fly and Oscinis frit, as well as for the species of Chlorops affecting grain, BRUMMER (*Abs. in Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 55, 56*).

Some unexpected results of spraying peaches, P. H. ROLFS (*Proc. Ann. Meeting Soc. Promotion Agl. Sci., 1895, pp. 40, 41*).—Winter washes were injurious to peach trees in Florida.

Transplanting insects, J. B. SMITH (*Ent. News, 7 (1896), No. 5, pp. 137, 138*).—Proposes introducing the predaceous enemies of *Aspidiotus perniciosus* from California into the Eastern United States.

A new case of parasitism observed with Chrysis shangaiensis, a chrysid parasite of a lepidopter, J. DE JEANNIS (*Bul. Soc. Ent. France, 1896, p. 117*).

Predaceous and parasitic enemies of aphides, including a study of hyperparasites, IV, H. C. A. VINE (*Internat. Jour. Micros. and Nat. Sci., ser. 3, 6 (1896), No. 80, pp. 157–178, pls. 2*).

White ants as cultivators of fungi, E. F. SMITH (*Amer. Nat., 30 (1896), No. 352, pp. 319–321*).—A reprint from an article by W. F. Gibbon in Grevillea, 1891.

Report of the entomologist, H. GARMAN (*Kentucky Sta. Rpt. 1894, pp. XIX–XXV*).—Brief remarks on the work of the division of entomology and botany during the year, 2 bulletins having been issued. Work was done on the grape pests, other insect and fungus pests, grasses, and broom rape. Statistics of the specimens in the collection and books in the library are included.

FOODS—ANIMAL PRODUCTION.

Corn and corn by-products, W. BERSCH (*Landw. Vers. Stat., 46, No. 2–3, pp. 85–102*).—This paper consists largely of compiled information on corn, its botanical characteristics, culture, uses, and diseases; the composition of corn fodder, stover, silage, "brown maize"—made by piling up partially wilted corn in layers and allowing to heat and ferment—kernels, meals, and by products from starch and glucose manufacture, distillery refuse, etc., and the digestibility of many of these materials.

In regard to the constituents of the kernel, it is stated that—

"The nitrogenous substance of the maize kernel consists for the greater part of plant fibrin, to which the kernel owes its horny character. There are also present

about 1.5 to 2 per cent of albumen and a little legumin. Mucedin, gliadin, and gluten are lacking altogether. The fat contains much glycerin, and among the fatty acids oleic acid predominates. Consequently maize oil, prepared on a commercial scale in France, Austria, and North America, is very thin. Cholesterin is also present in the fat, Soxhlet having found 3.31 per cent. Aside from the starch, which constitutes the principal part of the nitrogen-free extract, about 5 per cent of sugar and about 2 per cent of gum and dextrin are present. Windisch also recognized the presence of lactic acid in maize kernels."

Only occasional citations are made from the work done on corn in this country. The analyses given are largely taken from Dietrich and König's compilation.

Discussion of certain commercial articles: Foods, W. H. JORDAN (*Maine Sta. Bul. 20, 2d ser., pp. 4*).—This bulletin is largely made up of quotations from station publications. Condimental cattle foods, Imperial Egg Food, Nutriotone, etc., are discussed, and the fact is emphasized that "without exception, they consist principally of common cattle foods, or other common materials, mixed with small percentages of the cheapest and most ordinary medicinal substances." In the author's opinion these foods are sold at an exorbitant price, considering their value, and they are of no worth as medicines, since "if an animal is well no medicine is needed, if ill remedies adapted to the case should be administered. The farmer could manufacture his own condimental foods at a fraction of their usual cost by mixing a small amount of such common substances as salt, sulphur, saltpeter, fenugreek, caraway, etc., with the daily grain ration."

The influence of food combinations upon digestibility, W. H. JORDAN (*Maine Sta. Rpt. 1891, pp. 35–44*).—The idea is held by some that when two or more feeding stuffs are fed together the digestibility of each may be effected by the presence of the other. In these experiments, which were made with 3 sheep, the object was to determine the effect upon digestibility when silages from large immature southern corn and from mature flint corn were fed with timothy hay. Each of these was fed alone, and the hay was fed in combination with the two sorts of silage. The feces were collected during 5 days of each experiment.

The details are tabulated and summarized, and the results compared with digestibility calculated by the use of the coëfficients found when the feeding stuffs were fed alone. A summary of results is given in the following table:

Coëfficients of digestibility of hay and silage when fed alone and in combination.

	Dry matter	Ash.	Organic matter.	Protein	Fiber	Nitrogen free extract.	Fat.
Timothy hay, 600 gm. daily	*Per cent*	*Per cent*	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
Sheep 1	54.4	28.8	55.7	48.2	48.7	61.3	57.2
Sheep 2	52.7	28.2	54.0	42.7	48.9	59.6	41.8
Sheep 3	54.1	31.3	55.3	44.7	48.5	61.2	52.7
Average	53.7	29.4	55.0	45.2	48.7	60.7	50.6

Coëfficients of digestibility of hay and silage when fed alone and in combination—Cont'd.

	Dry matter.	Ash.	Organic matter.	Protein.	Fiber.	Nitrogen free extract.	Fat.
Southern corn silage, 2,000 gm. daily:	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sheep 1	64.6	52.3	65.7	59.8	68.5	65.1	67.8
Sheep 2	64.5	50.0	65.8	60.4	68.2	65.3	67.6
Sheep 3	61.8	46.5	63.1	59.7	65.8	61.8	68.4
Average	63.6	49.6	64.8	59.9	67.5	64.1	67.9
Maine flint corn silage, 2,000 gm. daily.							
Sheep 1	75.1	41.0	77.2	68.5	78.1	77.4	88.5
Sheep 2	76.0	39.4	78.2	64.9	79.2	79.8	85.8
Sheep 3	76.2	39.0	78.4	68.9	78.2	79.5	87.2
Average	75.7	39.8	77.9	67.4	78.5	78.9	87.1
Combination of southern corn silage and hay:							
Sheep 1	55.1	30.6	56.8	50.9	54.2	59.3	59.0
Sheep 2	58.9	38.4	60.3	52.0	56.0	63.9	64.4
Sheep 3	57.0	37.4	58.4	51.4	53.9	61.7	65.0
Average	57.0	35.6	58.5	51.4	54.7	61.3	62.8
Average digestibility as calculated	57.4	.....	58.5	52.4	55.5	61.9	58.7
Combination of flint corn silage and hay							
Sheep 1	73.6	49.0	74.8	68.6	70.3	77.8	80.4
Sheep 2	66.4	....	68.1	56.7	64.4	72.1	68.7
Sheep 3	67.1	....	68.6	59.6	63.1	72.7	73.2
Average sheep 2 and 3	66.7	....	68.3	58.1	63.7	72.4	70.9
Average digestibility as calculated sheep 2 and 3	63.1	....	64.7	56.3	58.9	69.0	68.0

"The outcome of these experiments does not give quite so definite testimony as is desirable. In the case of the hay and Southern corn silage combination the calculated and the actual digestibility agree very closely, while with the hay and field corn silage the actual digestibility is about 3.5 per cent greater than the calculated. Although this difference is not large, and might occur within the limitations of error with a single experiment, it seems desirable to secure additional evidence before formulating conclusions."

Dairy records, C. D. SMITH (*Michigan Sta. Bul. 127, pp. 3–16, figs. 6, pls. 4*).—The method of keeping the record of the college herd is explained; a description is given of the Babcock test, its operation, and the application of the results to herd records and to creameries and cheese factories; and a record is given for 3 cows for the whole or a portion of the year. These cows, Rosa Bonheur, Houwtje D., and Belle Sarcastic, were thoroughbred Holstein-Friesians.

A more detailed record is given for the cows for a shorter period. For Rosa Bonheur this covered 9 weeks early in the period of lactation, from February 20 to April 3. The average weight of the cow during this time was 1,750 lbs.; the average daily ration was 81.6 lbs. of silage, 11.99 lbs. of corn meal, 8.99 lbs. of oatmeal, 3 lbs. of bran, 6.31 lbs. of linseed meal, and 29.63 lbs. of mangel-wurzels. Calculated on the basis of average composition, the average daily ration contained 52.43 lbs. of dry matter, 5.25 lbs. of digestible protein, 27.27 lbs. of

digestible carbohydrates, and 2.05 lbs. of digestible fat. "Rosa consumed very much more than the standard of all the nutrients, especially of the protein."

The average daily yield of butter fat was 2.66 lbs., or 1 lb. for each 19.7 lbs. of dry matter eaten.

"This expenditure of dry matter for 1 lb. of fat would rightly be considered unusually economical under ordinary conditions, but this record was made in the coldest weather of an unusually cold winter, with the thermometer ranging below zero for several successive nights and with the cow in an isolated box stall with nothing between her body and the outdoor air except one thickness of boards loosely battened."

Rating the silage at $2, mangel-wurzels $2.50, hay $6, corn meal $19, bran $14, linseed meal $22.75, and oatmeal $16 per ton, the total cost of the food for the 9 weeks was $25.26. This would be 15.07 cts. per pound of butter fat, or with butter at 25 cts. per pound a profit of $23.59.

The total quantity of milk yielded during the 9 weeks was 5,820 lbs. Allowing 20 cts. per 100 lbs. for the skim milk, this would be worth $9.89, making the profit, as calculated, $33.48. The net food cost of the 167.64 lbs. of butter fat produced is given at 9.16 cts. per pound.

The detailed record for Houwtje D. covers a period of 19 weeks, from December 20 to May 1. The cow had calved the April previous. The cow averaged 1,600 lbs. live weight and was fed much as in the preceding case. The daily ration averaged 33.8 lbs. of dry matter, 2.87 lbs. of digestible protein, 18.57 lbs. of digestible carbohydrates, and 0.88 lb. of digestible fat.

"Since the cow weighed on the average during the winter 1,600 lbs., she had 21.12 lbs. of dry matter per day per 1,000 lbs. live weight. . . . It is evident that the cow was fed far less than she might reasonably have been expected to consume. . . . The total amount of fat excreted in the 19 weeks of winter feeding was 189.5 lbs., or about 1.4 lbs. per day. . . . The total cost for the feed . . . was $29.71. The average feed cost for a pound of fat, counting no other constituent of the milk of any value, was 15.67 cts. The cow yielded in the same 19 weeks 1,391.6 lbs. of milk. . . . Valuing the skim milk at 20 cts. per 100 lbs., the quantity yielded in the 19 weeks would be worth $7.17, leaving the net food cost of the butter fat $22.24, or 11.73 cts. per pound."

The detailed record of Belle Sarcastic covers 21 weeks, from December 12 to May 1. She had calved the April previous. She was about 5 years old when the record commenced. She averaged 1,550 lbs. live weight. The daily ration averaged 35.89 lbs. of dry matter, 3.18 lbs. of digestible protein, 18.82 lbs. of digestible carbohydrates, and 0.98 lb. of digestible fat. "On account of her immaturity no attempt was made to crowd the cow, and the ration was kept below the standard."

The total yield of fat for the 21 weeks was 230.67 lbs., or about 1½ lbs. daily. The average amount of dry matter eaten was 22.87 lbs. The total cost of feed was $40.75, or 17.66 cts. per pound of fat. Making the usual allowance for the value of the skim milk, $12.24, the net food cost of the fat would be $28.51, or 12.35 cts. per pound.

Remarks are made on the form of the dairy cow, variation in quality

of milk, and feeding suggestions. A table is given which shows the average amount of milk and fat given at the morning, noon, and night milking of Rosa Bonheur in 3 periods, 2 of 22 days and 1 of 23 days. The interval between milkings was the same, 8 hours. These data are given below:

Yield of milk, etc., at morning, noon, and night milkings.

	First period			Second period.			Third period.		
	Yield of milk.	Fat content	Yield of fat.	Yield of milk.	Fat content.	Yield of fat.	Yield of milk	Fat content.	Yield of fat.
	Pounds.	*Per ct*	*Pounds*	*Pounds.*	*Per ct*	*Pounds.*	*Pounds*	*Per ct.*	*Pounds.*
Morning	36 33	2 50	0 908	33 14	2 64	0 875	26 29	2.66	0.710
Noon	32 85	2 99	983	30 10	3 10	915	24 88	2.79	.692
Night	31 33	2 86	.900	30 40	2 87	872	22.19	2 62	.580

In conclusion, a summary is given of suggestions for the feeding and care of cows, based on the above observations.

Large or small hay ration (*Maine Sta. Rpt. 1891, pp. 41–50*).—This experiment was made with 3 milch cows and covers 3 periods of 4 weeks each. The cows received the same ration of grain and silage in all the periods except that in the first and last periods they received 13 lbs. of hay per day (5 lbs. being given as a noon feed) and in the second period only 8 lbs. The data for the experiment, including analyses of the milk, of the hay and silage fed, amounts of food consumed, etc., are tabulated in detail.

"The testimony of this experiment, as gained from observation of the animals and a study of the figures given in this connection, is unfavorable to the smaller ration of hay.

"The withdrawal of the noon feed of 5 lbs. of hay resulted in (1) a diminished flow of milk, (2) a loss of weight of the animals, and (3) an appearance of unthriftiness in the cows. . . Although the cows lost flesh and diminished greatly in their product, the quality of the milk seems not to have been influenced."

Fattening lambs, F. B. MUMFORD (*Michigan Sta. Bul. 128, pp. 47–65*).

Synopsis.—A comparison of different rations and treatment on 8 lots of 10 lambs. Feeding out of doors during winter was not as economical as feeding under cover and confined. Wheat compared favorably with corn and was profitable. Shearing in the fall previous to fattening was not found advantageous. Self-feeding was expensive and is not recommended. Roots *vs.* grain and pasture on rape *vs.* grass were also compared.

Eighty half-blood Hampshire lambs in reasonably good condition were purchased in the neighborhood early in October, and after pasturing on rape for about a month and subsequent barn feeding for 2 weeks longer were divided into 8 uniform lots of 10 each. The experiment commenced November 25 and continued until February 24, 13 weeks. Cut clover hay was fed to all the lots. In addition lots 1 and 2 received a mixture of corn and wheat, lot 1 being kept out of doors in a small yard and lot 2 under cover. Lot 3 had corn, lot 4 wheat, lot 5 a mixture of corn and wheat, and lot 6 sugar beets in place of grain to

compare these feeding stuffs, and in case of lot 5 to observe the effect of fall shearing, the results being compared with lot 2 on like food. Lot 7 received a "self feed" of corn, wheat, oats, and bran, the feed being placed in 4 self-feeders so arranged that the feed did not work down faster than it was consumed. The results were compared with lot 2, which received only corn and wheat. Lot 8 had been pastured on second-growth grass instead of rape previous to the experiment. They received corn and wheat like lot 2. The animals were confined in pens in a feeding barn except lot 1, each pen being lighted by a window, which was not closed except during severe storms, nor were the animals, except in lot 5, protected from the cold which might enter. In this case the pen was inclosed and the window was kept closed during the experiment. The animals were fed twice a day and were weighed each week under uniform conditions. The corn, wheat, and oats were fed whole. The beets were sliced.

The results are tabulated for each lot, showing the food eaten, gains, and financial results, the latter being based on corn at $19, wheat $17.83, oats $20, bran $14, sugar beets $2.50, and clover hay $8 per ton. The lambs were bought for 2.4 cts. per pound and sold for 5 cts., except lot 5 (shorn), which brought 4 cts. per pound and their wool 15 cts. per pound. The dealer who purchased the lot pronounced them unusually fine. He sold them at $6.10 per 100 lbs. The average results are shown in the following table:

Results of feeding sheep on different rations.

Lot.	Distinguishing rations	Total food eaten per lot: Grain	Hay	Water	Total gain of lot	Average dry matter eaten per pound of gain.	Grain eaten per pound of gain	Cost of food per pound of gain	Profit per lot.
		Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Cents*	
1	Corn and wheat (exposed)	1,196	1,087	1,228.0	205	9.65	5.84	6.9	$18.21
2	Corn and wheat (under cover)	1,164	1,173	2,073.5	230	8.77	5.06	6.1	19.39
3	Corn	1,208	1,142	1,945.5	233	8.12	5.18	6.3	18.67
4	Wheat	1,201	1,199	2,294.0	217	9.56	5.53	6.5	18.51
5	Corn and wheat (shorn)	1,266	1,336	1,848.5	161	13.97	7.86	9.7	10.45
6	Sugar beets	[1]5,685	1,181	364.5	116	15.16	[1]49.00	9.1	16.86
7	Corn, wheat, oats, and bran (self-fed)	1,460	924	2,547.5	206	10.04	7.08	7.5	17.01
8	Corn and wheat	1,232	1,209	2,191.0	249	8.48	4.91	6.0	18.25

[1] Sugar beets substituted for all the grain.

As between exposure and confinement (lots 1 and 2) the lot kept out of doors consumed slightly more grain but less hay and water, made less gain, and ate more dry matter per pound of gain than the lot kept confined under cover.

The comparison of wheat and corn shows "that while the wheat-fed lot made somewhat smaller gains and required more dry matter to produce 1 lb. of gain, the increase in live weight was on the whole rather above the average."

The financial results with lot 5 (shorn) as compared with lot 2 show "that in this experiment, at least, there was no advantage, but rather a disadvantage, from fall shearing. . . . The shorn lambs made smaller gains, ate more food, and consequently required more dry matter to produce 1 lb. of gain than the lambs fed in an exactly similar manner but not shorn."

The lot on roots in place of grain made the smallest gains and ate the largest amount of dry matter per pound of gain.

The self-fed lot (lot 7), as compared with lot 2, required more dry matter to produce a pound of gain and made a smaller total gain. The results on this point agree with results obtained in previous experiments (E. S. R., 6, pp. 239, 660) and are regarded as clearly against the use of self-feeders.

Lot 8, pastured on second-growth grass instead of rape previous to the experiment, was compared with lot 2 pastured on rape. The rape-fed lambs gained much more rapidly from the first, and the financial results show that they were more profitable, but the author points out that the test was not a fair one, since lot 2 was heavier than lot 8 at the beginning.

"The animals in this experiment fattened on rape during the fall and in good condition at the beginning of the experiment were essentially as successful feeders as those in poorer condition that were fed during the fall on ordinary grass pasture."

Report of poultry division, S. CUSHMAN (*Rhode Island Sta. Rpt. 1891, pp. 199-212*).—This contains an article on an infectious disease of turkeys mentioned elsewhere (p. 891) and remarks on the Rhode Island Poultry Association, a table poultry show in England, cross breeding of fowls, and experiments with geese. The latter gives brief mention of the results of the second season's experiments in crossing geese. The breeds and crosses tested were pure Black African, Embden-Toulouse, and crosses of Embden and Toulouse and of Wild Canada and Black African or India.

"According to the results the Black African is the best pure breed for profitable production, while the Embden, as regards early growth and quality when dressed, is more desirable than the Toulouse variety. First crosses from the best breeds gave better results than the pure breeds."

Experiments in egg hatching (*Dairy, 8 (1896), No. 87, p. 61*).—The reports of experiments by Madam Dieudonne upon the effect of cold upon the incubation of eggs, published by the French Minister of Agriculture, are quoted at considerable length. It was found that fowls hatch larger and stronger broods during the months of February, March, and April than during the warm months of June, July, and August. It was also found that the eggs of fowls which were at liberty hatched better than those of fowls which were confined. In tests made with an incubator it was found that eggs which were repeatedly cooled and warmed hatched much better than those which were kept

at a warm temperature all the time. In one experiment the eggs were cooled by exposing them to the air for 1½ hours daily during the whole period of incubation. This treatment retarded the period of incubation for 3 days. The eggs became quite cold and it required about 12 hours to bring them up to 104° F., the temperature of incubation. In this experiment 13 out of 16 eggs hatched vigorous chickens. The incubator had previously been used with unsatisfactory results.

From a second experiment it was inferred that the gradual heating of the eggs was as essential as the process of cooling. Twenty-five eggs which had been laid on very warm days were placed in the incubator and exposed to air as in the preceding case. The temperature was such that the eggs were warmed up to 104° in 2 or 3 hours. This temperature was maintained until the brood hatched. The chickens pierced the shell, but they were so weak that they died before leaving the egg.

It was found that the eggs upon which a fowl is sitting are not all of the same temperature, those upon the outside being cooler than those which lie inside.

Analyses of various preserved foods and preservatives, M. MANSFELD (*Ztschr. allg. österr. Apoth. Ver., 49 (1895), p. 701; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, pp. 617, 618*).—Pea soup preparations, baby foods, a substitute for white of egg, and several preservatives were analyzed.

Remarks on the chemistry of food preserving and the wholesale preparation of preserved foods (*Apoth. Ztg., 10 (1895), pp. 508, 524, 558, 617; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, pp. 616, 617*).—The author gives directions for preparing a fat for use in making various kinds of bread which may be kept for a long time. An analysis of bread 5 weeks old is given. The manufacture of meat powder, canned goods, etc., is discussed. The article includes descriptions of new processes and numerous tables.

The canning of meats for the French army (*Ber. pharm. Gaz., (1895), p. 659; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, pp. 618, 619*).—The regulations which govern this industry are given.

Somotose (*Apoth. Ztg., 10 (1895), p. 536; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, p. 492*).—A dietary experiment was made with somotose, an albumose preparation. Good results were observed. The subjects were invalids, convalescents, and children.

Food preparations, G. KLEMPERER (*Ber. pharm. Ges., 5 (1895), p. 283; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, p. 617*).—Meat powder, meat extracts, meat peptones, malt extracts, etc., are discussed.

Analysis of soup tablets, BARILLÉ (*Jour. pharm. Chim., 6 (1895), 11, p. 193; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, p. 492*).—The analysis is given of tablets 2 years old made from meat and legumes.

The value of sterilized milk as a food for infants, invalids, and convalescents, as shown by investigations of sterilized milk from the Brunswick dairy, R. BLASIUS and H. BECKURTS (*Deut. Vierteljahr. öff. Gsndhtspflg., 27 (1895), p. 537; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, pp. 501, 502*).—The authors regard sterilized milk as valuable and desirable food. The results of sterilizing milk in several ways are discussed.

A text-book of the science and art of bread making, W. JAGO (*London: Simpkin, Marshall, Hamilton, Kent & Co., 1895, pp. 618*).

The spirit of cookery, J. L. W. THUDICHUM (*London: Baillière, Tindall & Co.*

London and New York: Frederick Warne & Co., 1895, pp. VIII, 701).—This book, which is "a popular treatise on the history, science, practice, and ethical and medical import of culinary art," gives accurate descriptions of the principal dishes prepared by civilized nations. Much historical matter, a bibliography, and dictionary of culinary terms are included.

Cooking and diatetics, E. B. BORLAND (*Diet. and Hyg. Gaz., 12 (1896), No. 6, pp. 331–338*).—In an address the author discusses the subject with especial reference to the diet of invalids and its preparation.

Household economics as a university movement, H. CAMPBELL (*Review of Reviews, 13 (1896), No. 3, pp. 291–299*).—This is a popular article showing what is being done in this branch at several educational institutions.

Food and its functions, J. KNIGHT (*London: Blackie & Son, 1895, pp. 282*).— A text-book designed for students of cookery and food and diatetics. The chemical processes of the changes which food undergoes in the organism are treated of in detail. The various classes of nutrients are discussed and their functions pointed out. Several chapters are devoted to the physiology of digestion, respiration, and circulation, and the metabolism of matter and energy in the organism. The principal animal and vegetable food stuffs, condiments, and beverages are described at considerable length, and the diet best suited to persons of various ages in health and disease is discussed, as well as the methods of preparing and cooking foods.

Recent literature on the soja bean, H. TRIMBLE (*Amer. Jour. Pharm., 68 (1896), No. 6, pp. 309–313*).—A brief account of soja beans and soja bean products is given with many references to some of the more recent publications on the subject.

On maize, BALLAND (*Compt. Rend., 122 (1896), No. 18, pp. 1004–1006*).—Analyses are given and the nutritive values of maize and wheat are compared.

Feeding stuffs, N. E. WILSON and F. STADTMULLER (*Nevada Sta. Bul. 26, pp. 25, dgm. 1*).—The first part of the bulletin is made up of an explanation of the terms used in feeding experiments. The average composition of a number of American feeding stuffs, digestion coefficients, and feeding standards are quoted. Analyses are given of alfalfa, corn fodder, Polish wheat, buckwheat, beet leaves, and sugar beets.

On the normal occurrence of iodin in the animal body, L. BAUMANN and E. ROOS (*Ztschr. physiol. Chem., 21 (1896), Nos. 4, pp. 319–330; 5–6, pp. 481–493; trans. in Diet. and Hyg. Gaz., 12 (1896), Nos. 3, pp. 158–161; 6, pp. 353–359*).

On the influence of light on the formation of animal organs, J. LOEB (*Arch. Physiol., 66, No. 5–6, pp. 273–292*).

Guernsey cattle in Germany, HUCKO (*Deut. landw. Presse, 23 (1896), Nos. 39, pp. 343, 344; 40, pp. 350, 351; 43, p. 375*)

Breeds of cattle in Oudh (*Indian Agr., 21 (1896), No. 11, pp. 11–115*).

Statistics of the oysters raised on the coast of France, G. ROCHÉ (*Compt. Rend., 122 (1896), No. 17, pp. 955–957, dgm. 1*).

VETERINARY SCIENCE AND PRACTICE.

Turkey diseases, S. CUSHMAN (*Rhode Island Sta. Rpt. 1894, pp. 199–207*).—This contains notes on the various diseases of turkeys that have been studied at the station, the symptoms, pathology, and best methods of treatment being given.

A puzzling disease, commonly called "black head," attacking chiefly young birds and appearing in July and August and at the approach of cold weather, was studied. The affected birds usually have a diarrheal discharge, their feathers become rough, and the heads appear pinched and turn dark or purple. The birds appear to be better able to resist

the disease during warm, dry weather, but are quickly overcome in wet, stormy weather. "The disease apparently first attacks the cæcum or pronged part of the lower bowel, which eventually becomes thickened and enlarged, and often badly ulcerated. The liver is next affected, becomes spotted, and in advanced stages is covered with circular yellowish areas, showing destruction of tissue within the organ."

The disease was prevalent in various parts of the State to such an extent that an expert was detailed from this Department to investigate it.[1] Careful *post-mortem* examinations were made on over 50 young turkeys and the intestines of 25 more were examined. In the *post-mortem* studies the throat, trachea, lungs, liver, and entire length of the alimentary canal were examined. Microscopical examinations of the blood of the live birds and of the various tissues were made and bacteriological cultures were grown in tubes. The disease was determined to be due to a protozoan microörganism, thus showing that the disease is an infectious one and not due to tuberculosis or improper feeding, as had been suggested. The investigations are being continued, and the importance of stamping out the disease is insisted upon.

Notes are given on the presence of tapeworms in turkeys in different parts of the State, the birds being very generally infested. Those affected with "black head" were found to be free from tapeworms, but of 65 others examined the intestines of 40 contained tapeworms from a quarter of an inch to a foot or more in length. The duodenum was usually found to contain minute worms, while the lower intestines were often crowded with long, large ones. One small turkey 3 or 4 weeks old had many small worms in the duodenum, and the remainder of the intestines almost completely filled with about 50 worms several inches long. Most of the deaths occur among the turkeys under 3 months of age. It is not yet determined whether the embryo tapeworms are harbored in snails, earthworms, or insects, or whether the young turkeys are infected from the droppings of old birds. As a preventive, raising turkeys on uncontaminated land is recommended, and if the ground becomes infested, it should be frequently disinfected and the birds moved to new ground for several years. The administration of kousso is believed to be the best treatment, but male fern, tansy, areca nut, ground pumpkin seed, and asafœtida are also suggested. They may be given in either the feed or water.

Numbers of young turkeys were found to be infested with gapeworms, which proved most destructive when the turkeys were from 3 to 6 weeks old. The ordinary remedies were used with good results.

In some cases when turkeys appeared to be ailing, they were found infested with ticks and lice, the former being usually fastened to the head or neck.

Lame-sickness, J. D. BORTHWICK (*Agl. Jour. Cape Colony, 9 (1896), No. 6, pp. 141–144*).—Description and treatment of a disease of cattle, consisting of a paralysis due to the effusion of serous fluid into the membranes covering the brain and spinal cord.

[1] U. S. Dept. Agr., Bureau An. Ind. Bul. 8, pp. 7–38.

Mammitis mastito, inflammation of the udder and tubercular mammitis, T. WILLIAMS (*Jour. Bureau Agr. Adelaide, Australia, 8 (1896), No. 8, pp. 163, 164*).

On the milk fever of cows (*Deut. landw. Presse, 23 (1896), No. 30, p. 264*).

Tuberculosis and tuberculin injections, DEMAZUN (*Rev. Agr. Île Maurice, 10 (1896), No. 3, pp. 43-47*).

On tuberculosis of cattle (*Fühling's landw. Ztg., 45 (1896), No. 8, pp. 258-265*).

The suppression of bovine tuberculosis and glanders, F. L. RUSSELL (*Maine Sta. Rpt. 1894, pp. 156-162*).—A reprint of Bulletin 13 of the station (E. S. R., 6, p. 666).

Bovine tuberculosis, C. A. CARY (*Alabama College Sta. Bul. 67, pp. 197-226*).—This bulletin is a popular discussion of the subject of tuberculosis as affecting cattle and man. It treats of the history and statistics of tuberculosis, the biology of *Bacillus tuberculosis*, means of infection, the symptoms of differently located tuberculosis, the tuberculin test, etc. It is shown that human and bovine tuberculosis are caused by the same germ, and a number of instances are given of cases of tuberculosis in which the cause of infection could be traced.

Directions are given for preventive measures and the disinfection of tuberculous premises. The bulletin concludes with a discussion of precautions to be observed to limit the spread of tuberculosis among human beings.

Report of the veterinarian, F. L. RUSSELL (*Maine Sta. Rpt. 1894, pp. 124-133*).—This report consists of an article upon the value of tuberculin as a diagnostic agent for tuberculosis. The history of the use of tuberculin is briefly given, and the importance is urged of efforts toward the eradication of the disease. It is believed that with proper and continued efforts tuberculosis, both bovine and human, can be practically stamped out. Instances are given of the detection of tuberculous animals in various station herds, and directions are included for the avoidance of danger from tuberculous animals by preventive measures and the prompt destruction of all diseased cattle.

Elongation of the posterior members due to castration, LORTET (*Compt. Rend., 122 (1896), No. 11, pp. 819, 820*).

A new injector for pure serum, GABRITSCHEWSKY (*Centbl. Bakt. und Par. Med., 19 (1896), No. 14-15, pp. 551, 552, fig. 1*).

DAIRYING.

The composition of milk and milk products, H. D. RICHMOND (*Analyst, 21 (1896), Apr., pp. 88-92*).—This is a résumé of the work done in the laboratory of the Aylesbury Dairy Company during 1895. The average composition of the morning's and night's milk received from farms is given by months, as follows:

Composition of milk in different months.

Month	Morning's milk				Night's milk			
	Specific gravity.	Total solids.	Fat	Solids not fat.	Specific gravity.	Total solids.	Fat.	Solids not-fat.
	Per cent	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
January	1.0325	12.76	3.87	8.89	1.0323	13.15	4.23	8.92
February	1.0326	12.72	3.81	8.91	1.0324	13.16	4.23	8.93
March	1.0326	12.48	3.60	8.88	1.0324	12.88	4.00	8.88
April	1.0324	12.49	3.65	8.84	1.0322	12.86	4.03	8.83
May	1.0327	12.40	3.50	8.90	1.0323	12.74	3.90	8.84
June	1.0323	12.21	3.43	8.78	1.0309	12.49	3.78	8.71
July	1.0320	12.14	3.45	8.69	1.0315	12.51	3.87	8.64
August	1.0318	12.16	3.49	8.67	1.0314	12.60	3.96	8.64
September	1.0321	12.24	3.51	8.73	1.0316	12.59	3.91	8.68
October	1.0326	12.67	3.77	8.90	1.0321	13.15	4.30	8.85
November	1.0326	12.74	3.83	8.91	1.0322	13.10	4.24	8.86
December	1.0327	12.63	3.71	8.92	1.0324	12.97	4.08	8.89
Average	1.0824	12.47	3.64	8.83	1.0321	12.84	4.03	8.81

The above represents 11,081 samples. In no case did the mixed milk from any farm fall below 3 per cent of fat.

The average composition of asses' and goats' milk is given as follows:

Composition of asses' and goats' milk.

	Goat.	Ass
	Per cent.	*Per cent.*
Total solids	13.24	10.23
Fat	3.78	1.18
Sugar	4.49	6.86
Proteids	4.10	1.74
Ash	.87	.45

To test the view advanced in a former paper,[1] that the ratio of water to solids-not-fat was the same in cream as in milk, and that therefore the fat did not carry any proteids, a sample of unusually thick cream was analyzed. This contained 64.88 per cent of fat. The ratio was 100 parts of water to 10.4 parts of solids-not-fat—"identical with that in the milk used for its preparation." The range in composition of clotted cream is given. The fat ranged from 48.27 to 66.89, and averaged 58.21 per cent. "The ratio of the ash to solids-not-fat, 1:12, is the same in clotted cream as in milk."

The volatile fatty acids found during the year in French, Irish, and Australian butter are given, together with the water content of different kinds of butter. The latter is as follows:

Water content of butter, 1895.

	Maximum.	Minimum	Average.	Remarks.
	Per cent.	*Per cent*	*Per cent.*	
French fresh (unsalted) butter	18.00	12.25	14.78	
French salted butter	14.43	10.25	12.97	
Australian salted butter	15.72	9.09	12.82	
Irish butter	15.54	11.84	13.68	
English fresh (unsalted) butter, I	16.26	11.87	13.79	Direct from churning.
English fresh (unsalted) butter, II	15.71	12.50	13.54	24 to 48 hours old
English salted butter, I	18.06	11.77	14.74	Direct from churning.
English salted butter, II	16.63	10.30	13.33	24 to 48 hours old.
English salted butter, III	15.09	9.69	12.00	10 to 30 days old.

"It was found by experiment that the loss of water from salted butter was practically complete after the first week, and it is quite legitimate to average butters from 10 to 30 days old."

The water content of the unsalted French butter was 14.46 per cent in summer and 15.09 in winter; that of the English butter (all kinds) was 14.17 per cent in summer and 13.33 in winter.

The following deductions are made from the analyses of butter:

"(1) French butters, both fresh and salt, have contained fully 1 per cent more water than in former years (see former reports).

"(2) From the experiments on English butters it is seen that fresh butter loses a very small amount of water on keeping; salt butter, on the contrary, loses water

[1] Analyst, 19 (1894), p. 73 (E. S. R., 5, p. 1033).

very rapidly, especially during the first day or two after making, and more slowly during the next week, when the loss nearly ceases. It appears that the loss of water from fresh butter is due chiefly to evaporation, and the loss of water from salt butter chiefly to brine running out. It is interesting to note, in connection with this, that duplicate analyses of fresh butter (taken from different parts of a lump) have never differed more than 0.26 per cent, while differences of 0.7 per cent have been observed with salt butter.

"(3) French fresh butter contains more water in winter than in summer; English butters contain more water in summer than in winter. The number of English butters prepared in winter was, however, small. . . .

"(4) Taking butter from 24 to 48 hours old to represent commercial butter, it is seen that fresh butter on the average contains more water than salt butter. . . . There appears to be little foundation for the commonly accepted statement that salt butter contains more water than fresh butter.

"(5) It has been observed that, broadly speaking, the nearer the percentage of water is to 13.5 the better the quality of the butter, and that when the limits of 12 per cent on one hand and 15 per cent on the other are overstepped, there is, in a large number of cases, a marked falling off in quality. This rule is, however, far from absolute."

The author made a test of the method of detecting the addition of water to butter by means of the ratio of the solids not-fat to the water. Vieth[1] pointed out that in unwashed butters there were 10 parts of solids not-fat to 100 parts of water, while washed butters contained 5 parts to 100. He also pointed out that the variations were considerable. The author's observation of 109 samples of butter known to be without the addition of water, including some insufficiently worked, showed that the method can not be relied upon.

Water in Swedish butter (*Nord. Mejeri Tidn., 10 (1895), pp. 591, 592; Tidskr. Landtmän, 16 (1895), pp. 900–905*).—The average amount of water found in 1,011 samples of butter representing 277 different factories which exhibited at the permanent Swedish butter exhibitions in 1895 was 13.6 per cent. About 82 per cent of the samples contained between 12 and 15 per cent of water. The maximum water content for a single tub was 19.3 per cent, for a single creamery 16 per cent. Only 6.5 per cent of the creameries exhibiting, and 10.8 per cent of all samples, showed over 15 per cent of water. The corresponding data for the butter exhibited during 1894 were: Average 13.9 per cent; maximum 20.2 per cent, with 11.7 per cent of the creameries and 18.5 per cent of the tubs showing over 15 per cent of water. The average loss of brine from 68 tubs which showed a loss during storage (6½ per cent of the total number of tubs exhibited) during 1895 was 201 gm. (7 oz.).—F. W. WOLL.

The effect of boiling on the albuminoids of cows' milk, L. DE JAGER (*Centbl. med. Wiss., 34, pp. 145–150; abs. in Chem. Centbl., 1896, I, No. 14, p. 758, and Diet. and Hyg. Gaz., 12 (1896), No. 5, pp. 281, 282*).—The albuminoids were separated by the author's modification of Hoppe-Seyler's method,[2] using separator skim milk to avoid

[1] Analyst, 16.
[2] Chem. Centbl., 1895, II, p. 578.

the removal of the fat by ether. The total albuminoids precipitated by alcohol was 3.75 per cent. In the case of raw milk this consisted of 3.15 per cent casein and 0.25 per cent albumen. By means of rennet 2.8 per cent of curdled casein was found in raw milk and 3.1 per cent in boiled milk. When milk was saturated with magnesium sulphate the filtrate was free of albumen in the case of boiled milk, but in the case of raw milk still contained albumen. The author believes "that 2 kinds of proteids are present, an albumen and a globulin, the first of which is changed to casein by boiling and the last remains in solution."

According to the author, milk contains 3.15 per cent of casein, 0.35 per cent of albumen, and 0.25 per cent of globulin. Contrary to Ellenberger and Hofmeister, it was found possible to separate the curd from boiled milk with rennet, although it was more difficult than from raw milk. However, this curd from boiled milk behaved differently; it was easily soluble in dilute sodium hydrate, limewater, and sodium phosphate solution, and may have held much calcium phosphate in solution.

In the experiments on the behavior of raw and boiled milk toward artificial digestive fluids, 10 cc. of skim milk was curdled with pepsin, the curd finely divided by shaking, and 5 cc. of 1.8 per cent lactic acid added; and in another case 10 cc. of milk was mixed with 5 cc. of 1.8 per cent lactic acid and then the pepsin added. The inference of the author is that casein is more easily digested than cheese, and that the digestibility of milk is diminished by boiling. Likewise, when lactic ferment (1 cc. buttermilk) was added, much more of the cheesy precipitate from the raw milk than from the boiled milk was digested in 24 hours.

Relative efficiency of various preservatives in milk, R. T. THOMSON (*Glasgow City Soc. Rpts. 1895, p. 5; abs. in Analyst, 21 (1896), Mar., p. 65*).—The author kept measured quantities of milk to which the following substances had been added as preservatives: Forty per cent formic aldehyde (formalin), boric acid, boric acid and borax, salicylic acid, and benzoic acid. Different amounts of these were added, and the effect compared with no preservative, after 2, 4, 6, 7, 8, and 11 days. Formalin was the most effective of the preservatives. A mixture of boric acid and borax was more effective than boric acid alone.

The author deprecates the practice of using preservatives without proof of their harmlessness or without the knowledge of consumers.

The preservation of milk and cream for general household purposes, the nursery, and the sick room, R. BELL (*Dairy, 8 (1896), No. 86, p. 31*).—The author, who is a physician in Glasgow, advocates the use of harmless preservatives, and cites the case of a family which for 17 years used milk preserved with boric acid, bringing up 2 children upon it without injurious effect. "Nothing has ever occurred to the health of any them during all that time to direct a shadow of

suspicion to the effect of the continued use of this chemical in the milk. Their daily supply has averaged 2 pints to each individual, and this milk had 4 grains of boric acid to the pint in winter and 6 grains to the pint in summer, so that they each had 8 grains every day in winter and 12 grains every day in summer."

A new butter package (*Molk. Ztg., 10 (1896), No. 13, p. 201*).—A description is given, taken from the *Australasian*, of a package which is said to do away with the necessity for cold storage of butter. The butter is first packed in a box made of ordinary glass, the corners being fastened with gummed paper. A layer of plaster of Paris about 1 in. thick is placed over the glass box, and the brick is then wrapped in a paper specially prepared for the purpose. As the gypsum is a nonconductor of heat, it is claimed that the butter so packed is not injured by any changes of temperature. Butter packed in this manner in Melbourne was sent to South Africa, about 700 miles, and arrived in the same condition as when shipped. The cost of this method of packing is said not to exceed 2 cts. per pound of butter. The butter is sent as common freight, which results in a great saving of expense.

Boxes of 200 lbs. capacity are made for large creameries.

Milk, its nature and composition; a handbook on the chemistry and bacteriology of milk, butter, and cheese, C. M. AIKMAN (*London: Adam & Charles Black, 1895, pp. 180, figs. 21, pl. 1*).—The aim of this little book, as explained in the preface "is to give a short popular statement of the more important facts of the chemistry and bacteriology of milk." This has been done in a clear, concise style, and with a completeness that renders the book especially useful to students and those desiring a reliable modern handbook on the subject. The scope is shown by the table of contents for the 10 chapters, which is as follows: The structure of the cow's udder and the secretion of milk, the percentage composition of cows' milk, the constituents of milk, causes and conditions influencing the quality and quantity of milk, the changes which milk undergoes, the bacteria of milk, butter—importance of bacteria for butter making, rennet and its action, cheese, testing of milk, and milk as a food. The use of pure cultures, the transmission of diseases through milk, and the sterilizing and pasteurizing of milk are treated at considerable length. No attempt is made to deal with the practice of butter or cheese making. The matter is brought well up to date, and shows familiarity with the more recent scientific investigation and views. The author makes special acknowledgment to the works of Fleischmann, Kirchner, Fürstenberg, Duclaux, Freudenreich, Grotenfelt, and "the numerous valuable bulletins issued from time to time by the United State Government." There has been much need of a book of this kind for use in agricultural colleges, dairy schools, and the like.

Analysis of butter and imitation butter, J. M. BARTLETT (*Maine Sta. Rpt. 1894, pp. 12, 13*).—Analyses are given of 22 samples of butter and butter substitutes made in connection with the enforcement of the oleomargarine law of the State.

Bacteriological examination of sterilized milk, J. W. TROITSKY (*Arch. Kinderheilk., 19 (1895), No. 102, pp. 97–106; noted in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, p. 506*).

On the behavior of cholera bacilli in raw milk, BASENAU (*Arch. Hyg., 23 (1895), No. 2, pp. 170–183; abs. in Vierteljahr. Chem. Nahr. und Genussmtl., 10 (1895), No. 4, p. 506*).—Contrary to the opinion of Hesse, the author finds that raw milk does not possess the power of killing cholera bacilli. They remained alive 38 hours in milk which contained no other germs, and continued to increase until the milk became

sour, *i. e.*, thick. They also remained alive 32 hours in very impure milk kept at 37° and 24° and at ordinary room temperature.

A scheme for paying for cream by the Babcock test in butter factories, J. M. BARTLETT (*Maine Sta. Rpt. 1894, pp. 162–166, fig. 1*).—A reprint of Bulletin 15 of the station (E. S. R., 6, p. 847).

Chemistry and technology of cheese making, G. SARTORI (*Chemico e Technologia dei Caseificio; Vol. II, Technology. Turin: Unione Tipo-grafo Editrice, 1895*).

Dairying in Denmark, B. BÖGGILD (*Mælkeribruget i Danmark, 2d ed., Pt. I; Nordiske Forlag, Copenhagen, Denmark, 1896*).—This well-known authoritative work on Danish dairying by the present State dairy counselor of Denmark has been revised and brought up to date in this second edition. The book makes a complete handbook on dairying and will be illustrated with over 300 cuts of cattle, forage plants, dairy utensils, etc. It is published in about 20 parts of 32 pages each, and is expected to be completed before the end of the year.—F. W. WOLL.

AGRICULTURAL ENGINEERING.

Seepage or return waters from irrigation, L. G. CARPENTER (*Colorado Sta. Bul. 33, pp. 64, figs. 7, map 1*).

Synopsis.—Measurements of seepage on the Cache a la Poudre and South Platte Rivers in Colorado by E. S. Nettleton and the author and their associates since 1885 are tabulated and discussed. The value of the seepage water in the valley of the Poudre is estimated at $300,000 to $500,000, and of that in the Platte Valley at from $2,000,000 to $3,000,000. "It is of corresponding importance in the valleys of Clear Creek, St. Vrain, and others." The observations here recorded indicate that the value and importance of this water for agriculture will steadily increase.

A discussion is given of the character and importance of seepage from irrigation, the agricultural features of the Cache a la Poudre and South Platte Valleys, with locations of irrigation canals and irrigated lands; methods of gauging with conditions affecting accuracy; methods of irrigation practiced in these valleys; relation between seepage and the area irrigated and the water applied; and amount and rate of movement of seepage or underflow water as affected by rainfall, temperature, etc. Tables give data for measurements on these rivers by E. S. Nettleton and associates in 1885, 1889, and 1890, and by the author and assistants in 1891–1895. These data are summarized in the following tables:

Gain in seepage of Cache a la Poudre River.

[In cubic feet per second.]

	Oct., 1885.	Oct., 1889.	Oct., 1890.	Oct., 1891.	Mar., 1892.	Oct., 1892.	Nov., 1893.	Mar., 1894.	Aug., 1894.	Oct., 1895.
Canon to Larimer and Weld Canal	11.9	11.3	25.8	18.3	....	15.4	31.3	1.60	0.8	19.01
Larimer and Weld to No. 2 canal	25.5	36.8	13.7	8.7	......	12.0	11.9	30.67	17.4	13.60
No. 2 canal to Ogilvy ditch	49.5	44.5	38.1	38.3	......	45.1	38.0	29.80	72.0	55.90
Ogilvy ditch to mouth of Poudre	...	6.4	23.2	19.4	......	29.2	17.5	20.40	28.0	46.40
Total gain	86.9	99.0	100.8	81.6	96.1	101.6	98.7	82.30	118.2	164.40

Gain in seepage of South Platte River.

[In cubic feet per second.]

	No of miles.	Oct., 1889.	Oct., 1890.	Oct., 1891.	Mar., 1892.	Oct., 1893.	Oct., 1894.	Oct., 1895.	Average.
Mouth of Poudre to Hardin ditch......	8	49.0	68.7	75.5	69.1	69.0	23.9	79.0	62.0
Hardin ditch to Putnam ditch	12		−18.8	16.6	15.4	−33.7	50.5	43.0	17.2
Putnam ditch to Fort Morgan Canal...	14	51.3	27.0	15.3	29.5	[2]60.8	[1]68.3	[3]152.5	57.8
Fort Morgan Canal to Platte and Beaver Canal	11	......	6.5	38.3	[1]72.7	50.3	65.4	......	46.6
Platte and Beaver Canal to Snyder....	14	.....	17.1	98.2	...	15.0	24.8	94.3	49.9
Snyder to Merino	18	79.6	21.3	20.3	.	34.7	58.7	158.5	55.4
Merino to Sterling	14	32.8	29.7	33.4	....	33.8	[3]25.8	46.8	33.7
Sterling to Iliff	9	4.4	14.0	28.1	......	24.8	17.8	17.0	17.7
Iliff to Crook................	17	.....	.	13.1	...	...	0.1	−48.1	−20.3
Crook to State line...	36	...	....	3.3	......	......	34.2	−32.9	−21.3
Totals......	151	217.1	165.5	275.3	216.7	254.7	301.1	510.1	298.7
Average per mile	...	2.2	1.7	1.8	1.6	2.6	2.0	3.4	2.0

[1] Opposite Fort Morgan. [2] Schaefer's Ford. [3] Below Pawnee.

"We may draw the following conclusions from the observations and considerations shown. The facts are presented in sufficient detail to show the bases of these conclusions, or to enable independent conclusions to be reached, if the reader so desires:

"(1) There is a real increase in the volume of the streams as they pass through the irrigated sections, but no such increase occurs when the streams pass through unirrigated regions. On the contrary, there is an actual loss, even when the drainage of a large area enters.

"(2) The increase is approximately proportional to the irrigated area, and it seems probable that with more intimate knowledge of the amount of water applied and the features of the drainage the proportions would be found to be close.

"(3) The amount of the increase depends very slightly, if at all, upon the rainfall, and, so far as it does, it is influenced principally by the rainfall on the irrigated lands. Only where the lands are already saturated is the rainfall sufficient to cause seepage.

"(4) There is no perceptible underflow from the side channels, even where they drain several thousand square miles.

"(5) The inflow is practically the same throughout the year. It is greater in summer, less in winter, principally because of the effect of the temperature of the soil.

"(6) The passage of the seepage water through the soil is very slow, so that it may take years for the seepage from the outlying lands to reach the river, but it is constantly increasing, and may be expected to increase for some years to come.

"(7) The seepage from 1,000 acres of irrigated land on the Poudre River gives 1 cubic foot per second constant flow; on the Upper Platte, 1 ft. to about 430 acres; on the Lower Platte, 1 ft. to 250 acres. The difference is due mostly to the greater distance for the seepage to reach the main stream, and to the time and amount of water applied. One cubic foot per second of inflow is obtained on the Poudre River for each 2,400 acre-feet applied, or the inflow is about one-third as much as the water applied. About 30 per cent of the water applied in irrigation returned to the river.

"(8) The seepage being nearly constant throughout the year, while the needs are greatest in summer, the use of storage will best utilize the water from inflow. The use of water on the upper portions of a stream, when water is not immediately needed by prior appropriators, will increase the flow of the stream late in summer and prevent such low stages as it would have without this regulating action. Ultimately the returns from seepage will make the lower portions of such valleys as the Platte more certain of water, and an increased amount of land may be brought under cultivation, with time.

"(9) The seepage water is already an important factor in the water supply for the agriculture of the State. The capital value of the water thus received in the valley of the Cache a la Poudre alone is not less than $300,000 and perhaps $500,000, and

for the Platte is from $2,000,000 to $3,000,000. It is large for the other streams, but of unknown amount.

"(10) The results here shown may be expected to apply with limitations to other valleys similarly situated, where irrigation is as copious, crops the same in character, subsoil and rock strata of much the same inclination. Where the soil is less pervious, a greater time must elapse for these results to hold good."

Manual of irrigation engineering, H. M. WILSON (*New York: John Wiley & Sons, 1895, pp. 351, pls. 29, figs. 100*).—This work, by the chief geographer of the United States Geological Survey, is designed for those engaged in the study or practice of irrigation engineering as applied to Western conditions, and is chiefly the result of original investigation.

"The subject of the application of water to crops is but briefly touched upon. It would in itself require a volume, and is of more interest to the farmer than to the engineer."

The work is divided into 3 parts: (1) Hydrography, including precipitation; evaporation and absorption; runoff and flow of streams; subsurface water sources; alkali, drainage, and sedimentation; quantity of water required; pressure and motion of water and flow and measurement of water in open channels. (2) Canals and canal works, including classes of irrigation works; alignment, slope, and cross-section; headworks and diversion weirs; scouring sluices, regulators, and escapes; falls and drainage works; distributaries; and application of water, and pipe irrigation. (3) Storage reservoirs, including location and capacity of reservoirs; earth and loose rock dams; masonry dams; wasteways and outlet sluices; and pumping, tools, and maintenance.

Irrigation, T. LEBENS (*Ann. Sci. Agron., ser. 2, 1896, I, No. 2, pp. 243-263*).

Notes on the construction of dairies, F. W. WALKER (*Agl. Students' Gaz., 7 (1896), No. 6, pp. 209-211, pl. 1*).

STATISTICS.

Seventh Annual Report of Georgia Station for 1894 (*Georgia Sta. Rpt. 1894, pp. 187-195*).—A brief report on the work of the year, list of bulletins published, and financial statement for the fiscal year ending June 30, 1894.

Seventh Annual Report of Kentucky Station (*Kentucky Sta. Rpt. 1894, pp. I-LIII, 1-170, figs. 16*).—This includes a brief report by the director on the work of the year, reports from the divisions of chemistry, entomology, and botany and horticulture, a treasurer's report for the fiscal year ending June 30, 1894, reprints of bulletins 48 to 53, and an index. The work hitherto not reported is noticed elsewhere.

Reports of director and treasurer of Maine Station (*Maine Sta. Rpt. 1894, pp. 5-9*).—A brief review of the work of the year and a financial report for the year ending June 30, 1894.

Report of director of Pennsylvania Station for 1894, H. P. ARMSBY (*Pennsylvania Sta. Bul. 31, pp. 26, pl. 1, figs. 12*).—A reprint from the Annual Report of Pennsylvania State College for 1894 (pp. 13-34). The article gives a history of experiment station work, an account of the equipment and development of the Pennsylvania Station, the work of the station, its relations to agricultural education, and the agricultural courses of the college.

Reports of director and treasurer of Rhode Island Station, 1894 (*Rhode Island Sta. Rpt. 1894, pp. 91-109, 222-224*).—This includes a general report by the director reviewing the work of the station in its separate divisions during the year, the publications issued, a summary of the principal results obtained in the experiments described in detail elsewhere in the report, and a treasurer's report for the fiscal year ending June 30, 1894.

Seventh Annual Report of Texas Station, 1894 (*Texas Sta. Rpt. 1894, pp. 607-624*).—Short general reports are given by the director, chemist, veterinarian, horticulturist, and agriculturist; a meteorological summary by months; and a treasurer's report for the fiscal year ending June 30, 1894.

NOTES.

IDAHO STATION.—E. C. Egbert, a graduate of the agricultural department of Ohio State University, 1890, has been elected superintendent of the station at Moscow.

MINNESOTA STATION.—To extend the work of the experiment station, and especially to develop methods of farming and to develop and grow new kinds of seeds for distribution, 2 new experiment farms have been equipped, the Northwestern Minnesota Subexperiment Farm at Crookston, and the Northeastern Minnesota Subexperiment Farm at Grand Rapids in the "Pine Woods" part of the State. The legislature appropriated $10,000 with which to procure and equip each farm, but as the competing localities donated the farms, 450 acres in each case, the whole fund with some money bonus is being used for equipment. Five thousand dollars was also appropriated for maintaining each farm until the meeting of the next legislature. These farms are therefore to be provided for exclusively by the State.

Experiments on conservation of soil moisture, in making pasturage and meadows, and in growing forest and fruit trees in dry seasons have been started in southwestern Minnesota on the homestead of O. C. Gregg, superintendent of farmers' institutes, at Camden.

MONTANA COLLEGE.—Frank Beach, superintendent of the substation at Las Vegas, New Mexico, has been appointed professor of agriculture and irrigation engineering, and will enter upon his work at the college July 15.

NEW YORK CORNELL STATION.—B. M. Duggar has been appointed assistant cryptogamic botanist of the station.

WYOMING UNIVERSITY AND STATION.—Frank P. Graves, Ph. D., formerly professor of Greek in Tufts College, Massachusetts, has been elected president of the University of Wyoming and director of the station, *vice* A. A. Johnson, resigned.

C. B. Ridgway, late professor of mathematics in the University of the Pacific, Napa, California, has been elected professor of physics and mathematics in the university and physicist and meteorologist of the station. Professor Ridgway is preparing to do research work in the subject of soil physics, making a careful study of the soils of the arid region.

B. C. Buffum, in addition to his duties as agriculturist and horticulturist, has been elected vice-director of the station.

PERSONAL MENTION.—Dr. Georg Liebscher, director of the Agricultural Institute, University of Göttingen, died on May 8, in his forty-third year.

Dr. Victor Schiffner has been chosen professor of systematic botany at the University of Prag.

Drs. R. Wagner and A. J. Grevillius have become assistants in the Botanical Institute of Munich and Münster, respectively.

EXPERIMENT STATION RECORD.

VOL. VII. No. 11.

The testing of varieties, which has formed a more or less prominent feature of the work of many of our stations, is beset with many difficulties, and when properly carried out is not so simple a matter as might at first appear. On the contrary, it is regarded by authorities in such work as among the most difficult lines of field experimentation. While testing varieties on an extensive scale is not advocated, and while it is believed there are many other ways in which the stations can be quite as useful to the farmers in giving them practical aid, a limited amount of such work seems inevitable and is probably desirable, especially in the newer States. When undertaken it should be carried out in the same systematic, scientific manner as any other line of experiment, so that the final results may furnish reliable conclusions.

Assuming that the conditions as to uniformity of soil, vitality of seed, size of plats, and uniformity of treatment have all been considered and are ideal, one factor remains which is beyond the control of the experimenter. This is the meteorological conditions of the season, which not only affect the general yield of the crop, but often affect different varieties unequally. It has been demonstrated that a variety will retain its characteristic qualities for several generations when transferred to soils of different character or to regions of different meteorological conditions, though gradually the variety adapts itself to the new conditions. Hence, a test of varieties of wheat or corn covering one or two seasons does not demonstrate with certainty the relative adaptability to that locality of the varieties tested. This must be based on the average climatic conditions for the locality, and this average can be secured only by taking a number of consecutive seasons into account. The necessity for this was brought out by Professor Liebscher's experiments with varieties, noticed in a recent issue (E. S. R., 7, p. 861). His work in connection with the German Agricultural Society covered 5 consecutive years, and was carried out on 169 farms. In discussing the results he states that differences in yield in one or a few trials are not sufficient to demonstrate varietal differences, but that for this purpose a large number of trials, covering a number of years,

are necessary. The same point has been made in the variety tests at the Illinois Station, which have extended continuously over a number of years. In a late bulletin of the station, noted elsewhere, the authors state in their conclusions as to varieties that "it is only after a long series of years and from plantings in a variety of plats that anything like a true comparison can be established." The data published by the station during the past 8 years emphasize this point. Taking the 9 varieties of corn which were tested continuously for 8 years, the order of rank as to yield of shelled corn in the different years, and the average rank for the 8 years was as follows:

Order of rank of varieties of corn each year, and average for 8 years.

Varieties	1888.	1889	1890	1891.	1892	1893	1894	1895	Average for 8 years.
Leaming........	2	2	3	4	3	7	1	4	1
Burr White.... . . .	1	4	2	3	4	2	2	5	2
Clark Iroquois ..	9	3	6	5	2	4	8	1	3
Champion White Pearl	8	1	1	1	6	1	4	6	4
Legal Tender .	3	5	5	8	7	8	5	4	5
Murdock	6	8	4	6	9	6	7	3	6
Edmonds . .	4	6	7	7	8	9	6	2	7
Riley Favorite	5	7	8	9	1	3	3	7	8
Golden Beauty	7	9	9	2	5	5	9	8	9

The first year indicated Clark Iroquois and Champion White Pearl to be the poorest varieties for yield, while the averages for 8 years showed them to be third and fourth in order of rank. One year the Leaming was seventh, while the average placed it first; and in other years Riley Favorite and Golden Beauty were first and second, while the averages placed them at the end of the list.

Examples of this sort might be multiplied. Study of the data for numerous variety tests shows that when the tests are made apparently with great care and the unevenness of the soil checked by duplicating the plats, the order of superiority of the different varieties changes, more or less, from year to year, and that varieties differ considerably with respect to this variability in successive years. Some varieties keep about the same position in the order of rank, while others are up one year and down the next. This variability is an important factor in deciding upon the relative value of varieties.

Again, varieties which have been designated by one station as among the best have not infrequently been discarded after being tested at stations in adjoining States where the general conditions would seem to be quite similar. While it may be true that this difference in adaptability exists, the test covering only one or two years does not carry conviction.

While some stations have from the beginning insisted upon the importance of continuing the trials with the same varieties through a series of years, at others it appears not to have been appreciated, or to have been overlooked. As a result, comparatively few cases are found

where the same varieties can be traced through several years and the variation in relative yield from year to year studied. Although variety testing has remained a feature of the station work, there has been a frequent changing of the varieties under trial. Varieties disappear and reappear in the list without any apparent reason, and to a certain extent the list of varieties recommended undergoes similar transformation.

When we consider the effect of new conditions on a variety, that time is required for it to adapt itself to changed conditions, and that the conditions as to climate and soil are changing factors, the need of conducting variety tests in a strictly scientific manner, and of making the time limit sufficiently long to bring out the true merits of each variety, can hardly fail to be appreciated.

NITROGEN ASSIMILATION IN ITS APPLICATION TO PRACTICAL AGRICULTURE.

The discovery a few years ago that certain leguminous plants are able to assimilate the free nitrogen of the air gave rise to much research upon the subject, which has gradually developed and broadened until now nearly every phase seems to have been studied to a greater or less extent. The larger part of this investigation has been carried on abroad, though some important contributions have been made in this country.

Prominent among those abroad who have studied some phase of this subject may be mentioned Hellriegel and Wilfarth, Beyerinck, Nobbe and Hiltner, Frank, Salfeld, Prazmowski, Berthelot, Schlösing and Laurent, Petermann, and Lawes and Gilbert. In this country investigations have been reported by Atwater and Woods, Schneider, and Kedzie. A resumé of the earlier investigations upon this subject was given in two articles published in the Record by Prof. H. W. Conn.[1]

Following the demonstration of this ability of nitrogen assimilation came the discovery that it was due to the presence and activity of bacteria in nodules or tubercles on the roots. The character and life history of these bacteria were studied, the manner in which they bring about the fixation of nitrogen by the plant, the conditions most favorable for their growth, and their limitations. The organism, to which the names *Bacillus radicicola*, *Rhizobium mutabile*, etc., have been given, gains access to the plant from the soil, where it is usually present to some extent, through the root hairs. Once inside the root, it undergoes some rather remarkable modifications, losing to some extent its resemblance to a bacillus, as usually understood. The presence of the parasite in the root stimulates the host plant to produce the tubercle and provide the necessary nutritive substance for the growth of the organism, while in return the plant receives the nitrogen which the parasite alone can take from the air and render available for use. In this way a mutual dependence or symbiosis is set up between the host and its parasite. The exact nature of the transfer is unknown, but the plant is able in this way to elaborate the nitrogenous material into the proteids needed.

It is known that the best development of the organism takes place in soils poor in nitrogen, and that an abundant supply of nitrogenous fertilizer will partly or wholly prevent the formation of root tubercles. Weak and poorly developed plants, other things being equal, are the

[1] E. S. R., 2, p. 686, and 3, p. 56.

first to show the effect of the presence of the bacteria in a restored vigorous growth.

Hellriegel[1] found that leguminous plants would grow in sterilized sand without nitrogen and produce tubercles, provided there was added to the sand cultures a watery infusion of a soil in which legumes had been previously cultivated. This infusion furnished the plants with the bacteria required for the nitrogen assimilation. He further found that in the case of certain plants the extract of an ordinary fertile soil was not sufficient, but that an extract of a soil in which the particular crop had been previously grown was required to produce the development of root tubercles. This suggested that different kinds or forms of bacteria were responsible for the assimilation in case of different species of legumes.

Beyerinck studied the exact nature of the tubercles found upon the roots of many leguminous plants. He found that the bacteria from the tubercles on widely different species of plants agreed so nearly in external characteristics that he considered them identical, and described the organism under the name *Bacillus radicicola*.

Nobbe and Hiltner[2] considered it probable that the tubercles of each kind of plant possessed a particular kind of bacteria peculiar to the plant, and that it was necessary to insure the presence of the particular organism in order to secure the assimilation of the free nitrogen in the atmosphere. It was already known that the growth of certain leguminous plants which would not thrive in ordinary fertile soils could be greatly accelerated by adding to the plats soil from fields where similar crops had been grown. Nobbe and Hiltner prepared pure cultures of the specific organism which was believed to act favorably in the case of each leguminous crop, and used these for inoculation instead of soil. When examined microscopically the organisms obtained from the different leguminous plants could not be specifically characterized by their external appearances. It was believed that they underwent some alteration while in symbiosis with their hosts which rendered their subsequent action different in each case. They concluded that bacteria could not of themselves assimilate the free nitrogen, but that they were gradually changed in the nodules to a particular form known as "bacteroids." These, by their presence in the tubercles, presented a large surface to the air, which was thought to enable them to absorb the nitrogen and render it assimilable for the plant. It was further found that these tubercles attained their full efficiency only when the soil nitrogen had been nearly used up. Accordingly, the more nitrogen the soil contained the less was the difference between plants which had been inoculated and those which had not.

After much investigation as to the effect of the bacteria from the tubercles of different kinds of leguminous plants it was found that each kind of legume was most influenced by the bacteria peculiar to it,

[1] E. S. R., 3, p. 334. [2] E. S. R., 3, p. 336; 5, p. 110; 6, p. 504.

although among nearly related legumes the bacteria could be used interchangeably to a certain extent. Pure cultures of unlike origin represented no special kinds, but only adaptable forms. These were considered to be neutral bacteria and were able in a weak degree to enter into symbiosis with plants of the different genera of Leguminosæ.

Recent experiments of the authors in which *Phaseolus multiflorus*, *Pisum sativum*, *Vicia villosa*, *Lathyrus sylvestris*, *Trifolium pratense*, *Medicago sativa*, *Robinia pseudacacia*, *Lupinus luteus*, *Anthyllis vulneraria*, and *Ornithopus sativus* were inoculated with pure cultures of bacteria from tubercles of *Phaseolus multiflorus*, *Pisum sativum*, *Trifolium pratense*, *Robinia pseudacacia*, *Lupinus luteus*, and *Ornithopus sativus* showed [1] that only where inoculations were made with bacteria from the same kind of plants were the best results secured.

With the discovery of the fixation of the nitrogen of the air and the agency through which it is secured came the attempt to apply in practice what had been demonstrated in the greenhouse and laboratory, more especially in providing the soil with the necessary bacteria.

Some of the earliest experiments upon an extensive scale were those in which the soil was inoculated by spreading over the plat or field soil taken from a field in which the desired crop had been successfully grown.

In 1889 Salfeld began extensive series of experiments which he has conducted with soil inoculation as a means of increasing the growth of peas, beans, etc. In 1891 he published [2] the results of experiments with lupines in which the beneficial effect of soil inoculation was plainly shown. Hellriegel and Wilfarth [3] have also reported successful soil inoculations for lupines. Fruwirth [4] has experimented with soil inoculation for serradella, vetches, *Lathyrus sylvestris*, and lupines. Schmitter [5] has also made some very successful experiments along this line.

All these experiments had for their basis the application of varying quantities of soil from a field where a given crop had been successfully grown. In this way the presence of the organism which forms the root tubercles is assured. That this method is successful when applied in agricultural practice is demonstrated by the above experiments and by more recent experiments reported in detail by Salfeld.[6]

Another phase of the nitrogen assimilation in its practical application to agriculture was investigated by Schneider,[7] in which the author sought to develop through a series of cultures a form of organism that would be capable of living upon corn and other cereal roots and still retain its function of nitrogen assimilation. Cultures were made of the bacillus or Rhizobium from the tubercles on the roots of melilotus and

[1] Landw. Vers. Stat., 47 (1896), No. 4-5. pp. 257-268.
[2] E. S. R., 3, p. 553.
[3] E. S. R., 3, p. 334.
[4] Deut. landw. Presse, 1892, p. 14; 1893, p. 171.
[5] E S. R., 3, p. 491.
[6] Die Boden-Impfung, 1896.
[7] Ill. Sta. Bul. 29 (E. S. R., 5, p. 855).

on the common bean. Inoculations were made by pouring the infusion over the ground in which corn and oats were growing. It was claimed that the organisms were capable of being modified so as to grow upon corn roots to a limited extent, but not upon oats. The results of the experiments were rather of a negative character, although the author claimed that the presence of the organism in the corn roots increased the nutritive changes of the plant.

The use of pure cultures of the desired bacteria for inoculation has been developed by Nobbe and Hiltner as a result of their investigations mentioned above. These cultures, under the name of "nitragin," are now prepared on a commercial scale by Meister, Lucius, and Brüning, Höchst-on-the-Main, Germany. The substance is being tested quite extensively this year, and the originators, while expecting many failures until further investigations have shown more definitely what methods must be followed to secure its effective application in ordinary farm practice, believe it will in a few years be extensively used in the place of nitrogenous fertilizers. In order to prevent the securing of exclusive rights to manufacture this material by parties who had no part in its discovery, as well as to hold control of its preparation with a view to continuing investigations for its perfection, the originators have felt obliged to protect their rights by letters patent. They expect before long to publish detailed accounts of their investigations and they very much desire that extravagant anticipations regarding the practical utility of nitragin shall not be entertained by either investigators or farmers. They clearly recognize the fact that this whole subject has by no means been thoroughly investigated and that the utilization of the results of the scientific researches in this direction has not passed beyond the first stages of experimentation. The first public announcement of the extensive preparation of "nitragin" was made before a meeting of the German Agricultural Society, February 19, 1896. A few months later the Royal Agricultural Society of England sent Dr. A. Voelcker to Germany to investigate the claims and workings of this material. Dr. Voelcker's report has recently been published in the Journal of the Royal Agricultural Society.[1] On account of the interest attached to the subject and the reliability of the source of information, a portion of the report is reprinted in substance herewith.

In preparing "nitragin" for commercial use, Nobbe and Hiltner took the "pure cultivation" obtained as already described, transferred it, with suitable precautions, to a glass bottle holding 8 to 10 oz., and containing at the bottom a small quantity of agar-gelatin on which it was then allowed to grow; the bottle was sealed and the contents kept from the light. In this form the "nitragin" is available for use, and can now be purchased by anyone desirous of trying it.

Up to the present time there have been prepared and put on the market pure cultivations of the organisms derived from the nodules

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[1] Jour. Roy. Agl. Soc. England, ser. 3, 7 (1896), pt. 2, No. 26, pp. 253–264.

found on the roots, and suitable for application to the growth, of the following 17 leguminous field crops:

1.	Pea (*Pisum sativum*)	Pea family.
2.	Field pea (*Pisum arvense*)	
3.	Vetches or tares (*Vicia sativa*)	Vetch family.
4.	Field- or horse-bean (*Vicia faba* or *Faba vulgaris*)	
5.	White lupines (*Lupinus albus*)	Lupine family.
6.	Yellow lupines (*Lupinus luteus*)	
7.	Blue lupines (*Lupinus angustifolius*)	
8.	Red clover (*Trifolium pratense*)	Clover family.
9.	White clover (*Trifolium repens*)	
10.	Alsike (*Trifolium hybridum*)	
11.	Crimson clover (*Trifolium incarnatum*)	
12.	Cow grass (*Trifolium pratense perenne*)	
13.	Trefoil, yellow or "hop" clover (*Medicago lupulina*)	
14.	Alfalfa (*Medicago sativa*)	
15.	Sainfoin (*Onobrychis sativa*).	
16.	Serradella (*Ornithopus sativus*).	
17.	Flat pea (*Lathyrus sylvestris*).	

Others will be shortly added to the list, *e. g.*, kidney vetch (*Anthyllis vulneraria*), Bokhara clover (*Melilotus alba*).

Each bottle as sold bears a differently colored label, according to the kind of crop it is intended for, and also the German and the botanical name of the plant. The contents of a single bottle are sufficient for securing the inoculation of about half an acre of the land on which the crop is to be sown, and the present cost of a single bottle is 2.5 marks [or about 62 cents]. Thus the additional cost of inoculating a crop would come to about 5 shillings [$1.25] an acre. To look at, a bottle appears to contain at the bottom of it about an inch and a half depth of light brown jelly, ramifying throughout which may be noticed a white growth or mold. The two principal precautions that must be taken with the material are (1) not to let it experience a heat greater than the body temperature (about 98° F.); and (2) not to let it be exposed to a strong light. Either of these would destroy the vitality of the bacteria, but if they be guarded against, the efficacy of the contents may be prolonged for an indefinite time.

The German name for the material is *Impfdünger für Leguminosen* (inoculating manure for leguminous plants). "Nitragin" is the copyrighted name.

The method of using the "nitragin" in practical agriculture is twofold. It consists either in inoculating the seed direct, by bringing it, by means of water, into contact with the "nitragin," or in inoculating with the "nitragin" some of the soil of the field on which the crop is to be sown, and then spreading this soil over the plot and working it in to a depth of about 3 in. The first thing to be done is to render the contents of the bottle liquid; this is effected either by putting the bottle for a short time into lukewarm water, or by bringing it into a warm room until the contents become liquid, or by other obvious means.

Care must be taken, as already pointed out, not to exceed a temperature of 98° F. and not to expose the bottle to strong light. The following is, practically, a translation of the directions for use:

For inoculating the seed direct.—For every $\frac{1}{2}$ acre of land to be sown with the crop, take $1\frac{1}{8}$ pints of water in a vessel and pour into it the liquid contents of one bottle. In order to completely empty the bottle shake up some of the water with the liquid contents of the bottle so that the whole is well mixed, and then pour it into the vessel containing the water. With the water thus prepared, sprinkle the seed thoroughly, and work the heap with the hand (in the case of larger quantities with a shovel), so that every seed is moistened.

If there be not water sufficient add more, but, speaking generally, $1\frac{1}{8}$ pints is enough for small clover like seeds.

Dry the seed by mixing it with some dry sand or fine earth taken from the field that is to be sown. Avoid excessive dryness or dustiness, and do not expose to bright sunlight. Sow in the usual way.

For inoculating the soil.—Instead of inoculating the seed direct it is rather better to effect this purpose by inoculation of the earth of the field that is to be sown. To do this, for each $\frac{1}{2}$ acre of land that is to be sown, take 56 lbs. of earth from the field, and pour the contents of the bottle over it as directed before, but using very much more water. In this way the earth will be inoculated. Let the earth dry in the air, or, if necessary, add more dry earth.

Then spread the whole evenly over the surface to be sown with seed, and work it into the soil to a depth of about 3 in.

Sow the seed as usual.

As between the two methods of inoculation, that for inoculating the soil is considered by Dr. Nobbe the better (though the other may be more convenient), inasmuch as it would seem more certainly to insure that the organisms come in contact with the rootlets during their search for food. If the organisms remain merely as a coating over the seed they may possibly miss finding their way to the rootlets, but if they are distributed throughout the soil, the rootlets are almost certain to come in contact with some of the organisms in their passage through the infected soil. This is, however, a point that may be usefully experimented upon.

One of Dr. Nobbe's former assistants at Tharand—Dr. Gesell—who was associated with him in the inquiry, has now been established at the Höchst Farbenwerke, and it is under his direction that the various forms of "nitragin" are prepared.

The production of "nitragin" on a commercial scale having been of such recent date, there has been little time as yet, even in Germany, to make field trials of it under ordinary agricultural conditions. [During the present season, however, a considerable number of field trials are in progress in different countries of Europe at experiment stations and elsewhere. Personal observations by the Director of this Office of experimental plats at a number of European experiment stations

during July and August indicate that no very definite results will be obtained with nitragin as used at those places this season.]

The question now remains, of what practical utility to the farmers of this country is this discovery likely to be? Is it likely to enter into our ordinary farm practice, and will it pay to carry out?

While everyone interested in agriculture, and in agricultural science in particular, must feel that a great advance has been made in our knowledge of the hitherto unexplained and peculiar action of leguminous field crops, and must conclude that the matter is one that ought to be put to a trial, yet the need must be very apparent of thorough experimentation before one can absolutely come to a decision as to the practical value of the discovery.

The advantages which are stated to accrue to the use of "nitragin" on the seed are:

(1) Every single seed is surrounded with a covering of bacteria, which, after germination, penetrate into the root hairs and begin their activity in collecting nitrogen, so that without nitrogenous manuring, and even in soils poor in nitrogen, a good yield is assured.

(2) Through this activity of the bacteria, the soil becomes richer in assimilable nitrogen, which goes to benefit the succeeding crop also.

(3) The disadvantages of the method heretofore used, of inoculating with crude earth, are avoided.

(4) A manuring with nitrogen in the form of nitrates, ammonia salts, etc., is rendered quite superfluous.

The experiments of Dr. Nobbe and others which have been described before certainly offer strong evidence in favor of these conclusions. The practical question, however, is, whether, as a matter of agricultural experience, we do find soils under ordinary cultivation in which there is a deficiency of the organisms which are required for the proper development of our usually cultivated leguminous crops, and which enable them to assimilate the nitrogen of the atmosphere; and whether, as a consequence of such deficiency in quantity or absence of those kinds most favorable to the development of the particular crop, we should obtain a better yield of the leguminous crop, and at the same time lay up a larger store of nitrogenous food for the succeeding one, if we were to inoculate the seed or the earth in the way proposed. These are questions which can only be answered by practical trial.

Certain, however, it is that difficulty is not infrequently found in the growing of leguminous crops, and notably do we find failure of clovers. How far, again, the ill which we are in the habit of denominating "clover sickness" may be due to insufficient supply of organisms proper to particular leguminous crops, and how far to a fungus, is a matter of some doubt, and would well repay close investigation. At the Woburn Experimental Farm, for instance, it has been found impossible to grow white clover, red clover, alsike, or cow grass on the same

ground for more than 2 years in succession, though in the same field, and, indeed, only a few yards distant, red clover has been grown quite well in the 4-course rotation for 5 complete rotations. Similarly, trefoil and suckling clover have failed to establish themselves, though lucern, first sown in 1889, has lasted until the present time and has thriven capitally. It has, therefore, been arranged to try on this very land the growing of the different clover crops that have hitherto failed to establish themselves, but employing now the new inoculation method.

The main point appears to be whether it may not be wise to insure, by means of such inoculation method, that the organisms peculiar to each leguminous crop are present in sufficiency, so that the leguminous crop itself may grow more luxuriantly, and the soil be enriched in nitrogen for the after crop, and that both may in this way be rendered independent of any nitrogenous manuring, such as might otherwise have been supplied by dressings of nitrate of soda, ammonia salts, etc.

Although an abundant field for inquiry has been opened up, and though the present year's experiments must be necessarily tentative in character, in another year it is hoped that they will be extended, and also be tried on a field scale and on different classes of land.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

On the solution of cellulose by enzyms, J. GRÜSS (*Wochenschr. Brauerei, 12 (1895), p. 1259; abs. in Chem. Ztg., 20 (1896), No. 16, Repert., p. 48*).—Malt extract acts as a solvent on certain forms of cellulose, and the author has found that those celluloses which are easily hydrolyzed by dilute acids are also similarly changed by the ferments contained in malt. It was found that the various hemicelluloses differ in solubility and that the hydrolyzed and intact cell walls behave differently with coloring matters. The reaction with Congo red furnishes a means of distinguishing between the hydrolyzed and intact walls. In barley the cell walls are not dissolved, but the saccharocolloid present is converted into dextrinous substances. This property of malt extracts can also be detected chemically. Extended heating to 60° diminishes it.—W. H. KRUG.

Dextrinous compounds obtained from starch, K. BÜLOW (*Pflüger's Arch. Physiol., 62, 131; abs. in Ber. deut. chem. Ges., 29 (1896), No. 1, Ref., p. 11*).—Amylo-, erythro-, and achroo dextrin were prepared from starch and purified as thoroughly as possible. Amylo dextrin was obtained by the action of potassium hydrate, diastase, or sulphuric acid. All three were soluble in water with opalescence, were colored blue by iodin, and did not reduce alkaline copper solution even after boiling some time. The barium compounds of the amylo-dextrins obtained with potassium hydrate and diastase had the same composition, so that this form is probably a uniform chemical compound. It was only slightly soluble in hot water. The molecular weight of erythro dextrin is smaller than that of amylo dextrin, and that of achroodextrin smaller than that of erythro-dextrin.—W. H. KRUG.

Volemite, a new sugar, E. BOURQUELOT (*Jour. Pharm. et Chim., 6th ser., 2 (1895), pp. 385–392; abs. in Chem. Centbl., 1896, I, No. 1, p. 28*).—To prepare volemite 500 gm. of the dried and comminuted *Lactucamis volemus* is extracted by boiling once with 2 liters and twice with 1½ liters of 85 per cent alcohol. The extracts are mixed and filtered after cooling. The alcohol is then removed and the sirupy residue extracted with boiling 95 per cent alcohol. After several days the volemite separates from this extract in the form of small crystalline granules. The product is recrystallized from 8 parts of

boiling 80 per cent alcohol. Volemite is only slightly sweet, contains no water of crystallization, and melts at 140 to 142° (Fischer 149 to 152°). It is soluble in $4\frac{1}{2}$ parts water at 14° and slightly soluble in cold alcohol. $[\alpha]_D = +1.99$ (Fischer 1.92). Volemite has no action on an alkaline copper solution even after treatment with dilute sulphuric acid, is not fermented by beer yeast, gives no osagone with phenylhydragin acetate in aqueous solution, and gives a blue precipitate with ammoniacal copper solution. The acetyl compound crystallizes in white hexagonal leaflets, melting point 119°, $[\alpha]_D$ in acetic acid solution + 19.15°. The compound with ethyl aldehyde is crystalline, levorotatory, soluble in alcohol, and melts at 190°.—W. H. KRUG.

On the occurrence of two forms of mannan in the root of Conophallus konyaku, Y. KINOSHITA (*Coll. Agr. Tokio, Bul., vol. 2, No. 4, p. 205; abs. in Chem. Centbl., 1896, I, No. 1, p. 45*).—This root contains a soluble and an insoluble mannan. When the powdered root is extracted with boiling water, the insoluble residue on boiling with dilute sulphuric acid gives mannose. From the aqueous extract the soluble mannan is precipitated by alcohol. It is indifferent to diastase, invertase, and emulsin, and in general gives the same reactions as the mannan isolated from yeast by Salkowski.—W. H. KRUG.

On the determination of alumina in phosphates, H. LASNE (*Compt. Rend., 121 (1895), No. 1, pp. 63–66; abs. in Jour. Chem. Soc., 1895, Dec., p. 533*).—The method proposed is as follows: Dissolve 1.25 gm. of the phosphate in hydrochloric acid, evaporate the solution to dryness, take up the residue in the smallest possible amount of hydrochloric acid, and dilute the solution to twenty times its volume with water. Add an excess of sodium hydroxid free from silica and alumina and a slight excess of phosphoric acid in the form of sodium phosphate, heat to 100° in a nickel dish for about an hour, and make up the volume of the solution to 250.5 cc. Filter off 200 cc. of the solution, acidify, and add ammonium chlorid and a slight excess of ammonia. Filter, dissolve the precipitate in hot dilute hydrochloric acid, add 3.5 cc. of ammonium phosphate solution (1 to 100), nearly neutralize with ammonia, and dilute to 250 cc. Add 1.5 gm. of ammonium thiosulphate to the solution, boil for half an hour, add a few drops of a saturated solution of ammonium acetate, and again boil for 10 minutes. Filter, wash the precipitate with hot water, heat in a blowpipe flame for 15 minutes, and weigh.

The rapid determination of nitric nitrogen in vegetable products, P. PICHARD (*Compt. Rend., 121 (1895), No. 22, pp. 758–760; Rev. Scient., 1895, No. 23; Jour. Pharm. et Chim., 6th ser., 3 (1896), No. 2, pp. 79–81*).—The method proposed is as follows: Heat nearly to boiling point 2 to 4 gm. of fine-ground material with 20 cc. of distilled water in a long narrow test tube, hermetically seal the tube, shake it from time to time for a quarter of an hour, and cool. Filter the solution through a 10 to 15 mm. layer of purified boneblack and collect 10 to

15 cc. of the filtrate in a tube which is sealed until the solution is needed for test. For the test, place 2 cc. of the solution in a 50 to 60 cc. graduated cylinder, remove a drop of the solution to a white porcelain plate, add a drop of pure concentrated sulphuric acid, mix carefully with a platinum wire, and add a piece of brucin the size of a pin head and note the coloration. The 2 cc. remaining in the cylinder is now diluted until no coloration is observed when tested by the above method. This result is reached when the solution contains 0.0207 gm. of nitric nitrogen per liter. From the data thus obtained the percentage of nitrogen may be calculated. It is claimed that the method is rapid and accurate for 1 part of nitric nitrogen in 50,000 parts of water. When nitrites are present they should be destroyed by treatment with hydrochloric acid.

Determination of phosphoric acid soluble in ammonium citrate, G. APPIANI (*Staz. Sper. Agr. Ital.*, *28* (*1895*), *No. 12*, *pp. 817–832*).—Comparative tests of Petermann's method and the Italian official method on 30 samples of mineral phosphates (containing 13 to 18 per cent of available phosphoric acid) and 9 of bone superphosphates (13 to 19 per cent) are reported. In the Petermann method 2.5 gm. of the substance is stirred up with water in a mortar and the liquid decanted off through a filter, the filtrate being collected in a 250 cc. cylinder. The filter is washed until the filtrate amounts to about 200 cc., a few drops of nitric acid are added if the filtrate is turbid, and this is made up to 250 cc. The filter and contents are thrown into a 250 cc. flask, 100 cc. of alkaline ammonia citrate added (Petermann's[1]) and the solution digested for 15 hours in the cold, and for an hour at 35 to 40° C. When cold the volume is made up to 250 cc. with water and filtered. Fifty cubic centimeters of this solution is mixed with 50 cc. of the aqueous solution, acidified with nitric acid, and the phosphoric acid precipitated with molybdic solution (100 to 120 cc.). The washed precipitate is dissolved in ammonia (1 ammonia to 2 water), and the phosphoric acid precipitated with magnesia mixture.

In the Italian official method 5 gm. of the fertilizer is stirred up rapidly and gently with 20 cc. of water in a mortar and neutralized little by little with normal or nearly normal potash or soda, using litmus paper as an indicator. The contents of the mortar are washed into a 250 cc. flask with 200 cc. of ammonium citrate,[2] and the solution is made up to 250 cc. with water. After shaking vigorously, the solution is heated for 1 hour at 35 to 40° C., shaking from time to time. The solution is cooled and filtered and the phosphoric acid in 50 cc. of the filtrate diluted with 100 cc. of water is precipitated by adding 50 cc. of ammonia of 0.92 specific gravity and 50 cc. of magnesia mixture.

The results by the Petermann method were generally higher than those by the official method (26 out of 30 tests showing a plus error of

[1] See Wiley: Prin. and Prac. Agl. Analysis, Vol. II, p. 48.

[2] A neutral solution containing 400 gm. of citric acid per liter.

0.04 to 0.39 per cent in case of mineral superphosphates and 0.03 to 0.30 per cent in 8 out of 9 tests of bone superphosphates). Several possible causes of this are discussed. Experiments with different amounts of citrate in the official method indicated that the addition of as much as 50 cc. of citrate to a solution of phosphate containing 0.1561 gm. of phosphoric anhydrid reduced the amount of phosphoric acid precipitated 0.2 to 0.5 per cent. It appears probable, therefore, that while Petermann's method gave results too high, the official method, on account of the large amounts of citrate used, gave results which were too low.

For this reason the following modification of the official method was tested: Five grams of the superphosphate is placed in a porcelain mortar with 40 to 50 cc. of water, the lumps are crushed and allowed to settle and the solution is decanted off through a folded filter, the filtrate being collected in a 250 cc. flask. The washing by decantation is repeated 3 or 4 times, the water being allowed to remain only a short time on the substance. The material is finally washed on to the filter and the washing continued until the filtrate amounts to almost 250 cc. This is acidified with a few drops of nitric acid and made up to exactly 250 cc. The filter and contents are thrown into a 250 cc. flask containing 100 cc. of neutral or slightly alkaline ammonium citrate and digested at 35 to 40° C. for 1 hour with frequent stirring. The solution is then cooled, made up to 250 cc., and filtered. To a mixture of 50 cc. of this solution and an equal amount of the aqueous solution, 50 cc. each of water and ammonia of 0.92 specific gravity are added and the phosphoric acid precipitated by 50 cc. of magnesia mixture with vigorous stirring. The solution is allowed to stand for 5 or 6 hours. It is then filtered and the precipitate washed first by decantation and finally on the filter with 2.5 per cent ammonia until free of chlorids. It is dried and ignited first at a gentle heat and finally at an intense heat, cooled, and weighed. In comparative tests on 20 samples of phosphate this method as a rule gave higher results than the Italian official method and somewhat lower than Petermann's method.

The citrate solubility of phosphoric acid in Thomas slag, W. HOFFMEISTER (*Landw. Vers. Stat., 46 (1895), No. 1-5, pp. 399-405*).—The results of examinations of a large number of samples of Thomas slag are reported, which indicate that the citrate solubility of phosphoric acid depends not only upon the fineness, but upon the amount of lime and silica present. The larger the amounts of lime and silica the more readily the slag is ground to fine powder. The value of the slag is also increased by increasing the production of tetra-basic calcium phosphate in the fusion.

Examination of butter fat and butter substitutes, H. BREMER (*Forsch. ü. Lebensmtl. und Hyg. Chem., 2 (1895), No. 11, pp. 424-435*).—The author has made a quite comprehensive study of the sources of error in the Reichert-Meissl method. He gives the results of this

investigation and the details of a method which is a combination of the Reichert-Meissl and the Köttstorfer methods. The object in uniting these 2 methods is said to be to avoid the errors in saponifying by the Reichert method, especially the absorption of carbonic acid, and the decomposing action of the excess of alkali on the alcohol and the fat, and to allow the alcohol to be completely removed without damage by means of a current of air. The method in detail is as follows:

Exactly 5 gm. of melted, filtered, and well-mixed water free fat is weighed out in a 300 cc. Schott flask, and to this is added 10 cc. of the alkali, containing 1.25 to 1.35 gm. of KOH dissolved in 70 per cent alcohol, accurately measured with a pipette. The flask is connected with a tube about 1 meter long, closed at the upper end with a Bunsen vent, and placed on a water bath. As soon as the alcohol begins to condense in the tube and drop back, the contents of the flask are agitated by a rotary motion over the bath until the solution is homogeneous. The heating is continued for 5 or at most 10 minutes, with frequent agitation. As soon as the liquid has cooled so far that no alcohol condenses in the tube, air is allowed to enter through the vent, the tube is disconnected, and the solution at once titrated to a red color with alcoholic normal sulphuric acid, using 3 drops of phenolphthalein as indicator. Then 0.5 cc. more of the indicator is added and the titration carried drop by drop to a pure yellow color. The saponification equivalent is calculated from the acid used, when the exact strength of the alkali has been determined. To the flask is then added about 10 drops of the alcoholic potash, and the alcohol entirely removed by heating on the water bath with frequent shaking at first and finally by means of a current of air. The dry soap is dissolved by heating in 100 cc. of water free from carbonic acid, then cooled to about 50°, a few pieces of pumice stone and 40 cc. of dilute sulphuric acid (1 volume of acid to 10 of water) added, and 110 cc. distilled off in the ordinary way. One hundred cubic centimeters of the distillate is titrated with decinormal alkali and phenolphthalein, the result multiplied by 1.1, and the result found in a blank determination subtracted from the product.

The above method, it is claimed, is so exact that butter fat can be reliably determined in margarin and other artificial fats, provided the content of volatile fatty acids of the other fats in the mixture is known. Of the fats commonly used for this purpose only cocoanut oil and palm oil have any considerable volatile fatty acids, and these fats are easily recognized by their abnormally high saponification equivalent and iodin number, and approximately quantitatively determined. Beef fat from different parts of the carcass differed but slightly in volatile fatty acids and in saponification equivalent. For mixtures of beef fat as used in the manufacture of oleomargarin the author gives the extreme limit of volatile fatty acids at 0.3, and for oleomargarin made with lard (talgen)

0.5. The amount in excess of these for a fresh artificial butter is, in the absence of cocoa fat or palm oil, to be ascribed to milk or butter fat.

The estimation of fat in meat, C. DORMEYER (*Pflüger's Arch. Physiol., 61, 1895, pp. 311–313*).—The author states that by extracting meat (dried in a vacuum and finely powdered) for 100 hours with ether, only 75 to 80 per cent of the fat can be obtained. If the residue is again finely ground and extracted more fat can be obtained. After it has been powdered daily for 5 months the meat was not entirely free from fat. The author therefore proposes a new method of determining fat. According to this the meat is digested with pepsin and hydrochloric acid, and the fat removed by shaking out with ether. It is believed that all the fat can be thus obtained. Experiments made by this method showed that meat extracted in the usual way still contained 0.75 per cent of fat.

Is it possible to obtain meat of uniform nutritive value by removing the fat by mechanical means? H. STEIL (*Pflüger's Arch. Physiol., 61, 1895, pp. 313–358*).—The author removed all visible fat possible by mechanical means, and determined the fat remaining by Dormeyer's method. It was found that the fat thus obtained varied very considerably in different cuts and in different samples from the same cut, in one instance from 0.85 to 3.30 per cent. The author concludes that removing the fat by mechanical means does not give meat of uniform composition.

Examination of fat with the refractometer, H. BECKURTS and H. HEILER (*Arch. Pharm., 233, No. 6, pp. 123–128*).—In the examination of a considerable number of fats and oils with the refractometer, butter and margarin were included. The effect of temperature on the refractive index has been known. Wollny, Mansfeld, Halenke, and others give the difference corresponding to 1° C. increase as 0.53 for butter and 0.56 for margarin. The authors found in examining 17 samples of butter that only 2 samples showed a difference of 0.52. The difference was greater the higher the volatile fatty acids. For margarin the difference was found to be 0.56 for 1° C.

The line of refraction was not always colorless with pure butter. In 3 samples of pure butter, which at 25° C. showed a refractive index of 52.7, 52.8, and 53, the line was blue, like margarin.

Examination of 20 samples of market butter showed no parallelism between refraction and volatile fatty acids (Reichert-Meissl); but a certain parallelism was apparent between refraction and iodin number.

The detection of watered milk by the examination of the milk serum, LESCOEUR (*Congress Intern. Chim. Appliq., Compt. Rend., Brussels, 1894, pp. 60–62; abs. in Analyst, 20 (1895), No. 234, p. 200*) —The density of milk serum is given as from 1.029 to 1.031 at 15° C.; 1.027 is regarded as the minimum limit. The "extract" of the serum is said to vary from 67 to 71 gm. per liter. Any sample of milk falling below the above minima is to be regarded as watered. From some trials reported

it appears that the addition of about 4 per cent of water to milk lowers the specific gravity by one-thousandth and the weight of extract by 2 units.

The method is said to be applicable to sour, curdled milk.

Determination of fat in milk, A. LIEBRICH (*Chem. Ztg.*, *20* (*1896*), *No. 3, p. 21*).—About 10 cc. of milk is shaken vigorously with a little ignited quartz sand and 100 cc. of ether. About half the ether which rises on standing is evaporated and the fat weighed. The author claims that the method is "simple and exact."

The action of basic lead acetate on sugar solutions, H. SVOBODA (*Ztschr. Ver. Rübenz.-Ind.*, *46* (*1896*), *No. 181; abs. in Chem. Ztg.*, *20* (*1896*), *No. 30, Repert.*, *p. 98*).—Basic lead acetate decomposes sugar solutions, as is shown by the coloration and decrease in polarization. This decrease varies with the sugars, being lowest with maltose and highest with galactose. Sucrose and raffinose solutions are not decomposed. The decrease in rotatory power varies with the basicity of the lead acetate, and is due to the formation of soluble lead saccharates, whose rotation differs from that of the sugar.—W. H. KRUG.

Action of sugar on ammoniacal silver nitrate, J. HENDERSON (*Jour. Chem. Soc.*, *69* (*1896*), *p. 145*).—The author has found that with dextrose, levulose, and galactose definite factors can be obtained under given conditions. Cane sugar, starch, and dextrin, when heated under the same conditions, exert no reducing action, and in the case of lactose and maltose no definite factors can be obtained on account of the gradual hydrolysis of the disaccharid molecules by the ammonia. The factors for dextrose, levulose, and galactose were not affected by changing the amount of ammonia present.—W. H. KRUG.

The analysis of oak wood extract by the hide powder method, F. CERYCH (*Der Gerber*, *1895*, *21*, *211; abs. in Jour. Soc. Chem. Ind.*, *15* (*1896*), *No. 1, p. 11*).—The inequality of the powder is the most serious source of error in the hide powder method. This can be avoided by washing sufficiently with cold water; but another error is then introduced by the removal of the soluble gelatin when the percolation method is used. This appears to be due to the fact that the liquid which passes up the sides of the tube does not come in contact with the powder sufficiently, and the presence of the soluble gelatin insures absorption in this portion. To avoid this the hide powder is mixed with disintegrated filter paper. One hundred grams of good hide powder is washed and intimately mixed with a cream of 35 gms. of filter paper. The water is squeezed out and the mass dried in a current of cold air. It is then ground until woolly, and dried over sulphuric acid until it contains 1.5 per cent water. Nine grams of this serves for a determination. The passage of the tannic solution through the percolator should occupy from 2 to 3 hours. In order to obtain concordant results with hide powder it is necessary to purify it in the manner indicated, to use always the same amount of extract for analysis, and to work at the same temperature, 18 to 20°.—W. H. KRUG.

The condensation of tannins with formaldehyde, E. MERCK (*Merck's Rpt. for 1895, pp. 14–19; abs. in Chem. Centbl., 1896, I, No. 10, p. 560*).—Tannins can be easily removed from purified plant extracts by treatment with formaldehyde in the presence of hydrochloric acid. These condensation products are called "tannoforms," and are insoluble in water but soluble in warm concentrated sulphuric acid, with which they give characteristic reactions.—W. H. KRUG.

The relation between the chemical constitution of organic compounds and their oxidation by laccase, G. BERTRAND (*Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 12, pp. 791–793*).

A new "oxydase" or soluble oxidizing ferment of vegetable origin, G. BERTRAND (*Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 12, pp. 793–797*).

Constitution of the cereal celluloses, C. F. CROSS, E. J. BEVAN, and C. SMITH (*Jour. Chem. Soc., 1896, June, pp. 804–815*).

On the chemical mechanism of the reduction of nitrates and of the formation of quaternary nitrogenous matter in plants, A. BACH (*Compt. Rend., 122 (1896), No. 25, pp. 1499–1505*).

The mode of formation of carbonic acid in the burning of carbon compounds, H. B. DIXON (*Jour. Chem. Soc., 1896, June, pp. 774–789, fig. 1*).

Carbon dioxid—its volumetric determination, W. H. SYMONS and F. R. STEPHENS (*Jour. Chem. Soc., 1896, June, pp. 869–881, figs. 3*).

Identification and separation of the principal acids contained in plants, L. LINDOT (*Chem. News, 73 (1896), No. 1909, pp. 295, 296*).

The determination of oxygen in water, G. ROMIJN (*Rec. trav. Chim. Pays-Bas, 15, p. 76; abs. in Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 12, p. 820*).—The method is based on the oxidation of manganous salts.

Citrate soluble phosphoric acid, O. REITMAIR (*Ztschr. angew. Chem., 1896, No. 7, pp. 189–194*).—A general discussion of the applicability of Wagner's method and other methods.

Acidimetric estimation of vegetable alkaloids—a study of indicators, L. F. KEBLER (*Chem. News, 73 (1896), Nos. 1908, p. 287; 1909, pp. 298, 299*).

The determination of caffein in tea, A. PETIT and P. TERRAT (*Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 12, pp. 811–815*).

The probable error of the rapid methods of Babcock, Gerber, and Thorner in comparison with gravimetric determination of milk fat (sand method), H. SCHROTT-FIECHTL (*Milch Ztg., 25 (1896), Nos. 12, pp. 183–185; 13, pp. 199–201; 14, pp. 217–220*).

Determination of casein in milk, DENAEYER (*Jour. Pharm. et Chim., ser. 6, 16 (1896), III, No. 12, pp. 610, 611*).—Ten cubic centimeters of milk is precipitated with 200 cc. of 95 per cent alcohol. The precipitate is collected on a filter and washed with alcohol and ether. The filter with the precipitate is thrown into a Kjeldahl flask and nitrogen determined as usual.

Official methods of analysis (*U. S. Dept. Agr., Division of Chemistry Bul. 46, pp. 84, figs. 4*).—The methods adopted by the Association of Official Agricultural Chemists at the convention September 5, 6, and 7, 1895, edited by H. W. Wiley, secretary, with the collaboration of L. L. Van Slyke and W. D. Bigelow of the editorial committee of the Association. The methods have been subjected to a careful editing and revision, and their usefulness will no doubt be greatly enhanced on this account.

A new Bunsen burner, K. DIERBACH (*Ztschr. angew. Chem., 1896, No. 8, p. 233; Ber. deut. chem. Ges., 29 (1896), No. 6, p. 865, figs. 3*).—The tube of the burner is an adjustable stand, so that it may serve as a low or tall burner, or the flame may be directed at any angle.

A new cooler, R. WALTHER (*Chem. Ztg., 20 (1896), No. 47, p. 462, figs. 3*).

A new apparatus for the determination of melting points, M. KAEHLER and MARTINI (*Ztschr. angew. Chem., 1896, No. 7, p. 195*).

BOTANY.

Studies on the assimilation of free nitrogen by plants, J. STOCKLASA (*Landw. Jahrb., 24 (1895), No. 6, pp. 827–863; abs. in Jour. Chem. Soc., 1896, March, pp. 203–207*).—The author has divided his investigations into five groups, viz: (1) Is the assimilation of the free nitrogen of the air only possible through the root tubercles of leguminous plants? (2) chemical investigations of leguminous root tubercles, (3) concerning the assimilation of elementary nitrogen through the living protoplasm of the green plant cells, (4) bacteriological investigations of the soil in which the plants grew, and (5) can bacteria and algæ assimilate elementary nitrogen?

Field experiments conducted with lupines (*Lupinus angustifolius*) in a poor, sandy loam containing 0.023 per cent nitrogen showed that plants without tubercles grew as well as those possessing them. The total nitrogen content of both plants was practically the same at the time of flowering, although somewhat differently distributed in the plant. Those without tubercles contained more nitrogen in their stems and leaves, while those possessing tubercles contained more nitrogen in their roots than the others. A series of pot experiments was undertaken as follows: (1) In sterilized sand, (2) sand sterilized and inoculated, (3) sandy soil containing 0.0065 per cent nitrogen in which algæ and bacteria were permitted to grow, and (4) same as 3, with an inoculation of lupine soil. The nitrogen supplied to all the pots was 0.069 gm. in seed, 0.199 gm. estimated as having been absorbed as ammonia and nitrates from the air, that amount being present as shown by meteorological data, and 0.152 gm. in the lupine soil added to the inoculated pots. In each series 12 to 16 pots were used, but in the following table only 10 plants were analyzed from each set:

Nitrogen balance with sterilized and inoculated soils.

	Dry produce (10 plants)	Nitrogen Supplied.	Nitrogen In produce	Gain.
	Gms	*Gms*	*Gms*	*Gms.*
1. Sterilized	27.86	0.268	0.459	0.191
2. Sterilized and inoculated	64.85	.420	1.995	1.575
3. Not sterilized	66.40	.268	2.394	2.126
4. Not sterilized and inoculated	63.85	.420	2.510	2.090

From the above table it seems that there was some fixation under conditions of sterilization, although the amount was greatly increased where inoculation was introduced. The total nitrogen content of the soil in series 3 and 4 rose from 0.91 gm. per pot at the beginning to 1.372 and 1.456 gm., respectively.

In summing up the results of these experiments the author concludes that nitrogen assimilation under conditions of sterilization is very

feeble, while inoculation increased it fully 8 times, and that lupines without tubercles grown in non-sterilized soil in which algæ and bacteria had supplied the nitrogen required for the earlier development of the plants assimilated as much elementary nitrogen as those plants possessing them.

Microscopic examination of leaves from plants grown in sterilized soil showed that the cells of the pallisade parenchyma contained a less number of chlorophyll grains than normal or in those grown in inoculated soils.

Chemical examinations were made of the tubercles found on the roots of *Lupinus luteus*, and no ammonia was found and only traces of nitric acid, which disappeared at maturity of the plant. The nitrogen of the roots and tubercles was compared at 3 stages of growth, viz: At flowering, nitrogen content of roots 1.64 per cent, of tubercles 5.22; at fruit formation, roots 1.84, tubercles 2.61 per cent; and at maturity, roots 1.42, tubercles 1.73 per cent of their dry weight. The nitrogen compounds in the tubercles was found at flowering time to be as follows: Proteids 3.99, amids 0.35, and asparagin 0.34. At maturity the same substances were present as follows: Proteids 1.54, amids 0.15 per cent, and asparagin trace. The ash analyses of roots and tubercles showed total ash of roots 4.55 per cent, of which 14.52 per cent was potash, 26.88 soda, 16.87 lime, 11.73 magnesia, 1.08 iron oxid, 9.82 phosphoric acid, 15.84 sulphuric acid, and 3.59 silica. The ash of the tubercles, which was 6.32 per cent of their dry weight, contained 20.86 per cent potash, 22.74 soda, 10.71 lime, 12.35 magnesia, 1.19 iron oxid, 14.94 phosphoric acid, 12.25 sulphuric acid, and 3.01 silica.

In order to test the effect of light upon the development of tubercles, plants were kept 13 days in the dark, or until they had become etiolated, when leaves and tubercles of normal and etiolated plants were analyzed with the following results:

Nitrogenous constituents of leaves and tubercles.

	Leaves				Tubercles			
	Nitrogen		Asparagin	Lecithin	Nitrogen		Asparagin	Lecithin.
	Total	Protein			Total	Protein		
	Gms	*Gms*	*Gms*	*Gms*	*Gms*	*Gms*	*Gms*	*Gms*
1 Grown in light	3 29	2 87	0 49	1 24	4 99	3 96	1 37	1 12
2 Grown in darkness	3 47	1 80	4 19	0 68	3 11	1 47	4 98	0 53

From the above it is claimed that the plasma of the tubercles, together with the bacteria, are incapable of supporting independent processes of nitrogen assimilation, and that assimilation takes place in the leaves, the amids migrating to the root tubercles, where, acting with glucose, they produce proteids, the nutrient medium for the bacteria.

The author, from 5 years' experiments with buckwheat grown under various conditions of sterilization, etc., claims that under conditions of

complete sterilization there was an assimilation of free nitrogen in small quantity. Where algæ and bacteria were allowed to grow a marked increase took place, while in one series, where ammonium nitrate 0.5 gm. per pot was added to unsterilized pots, there was a gain of over 40 per cent over the sterile pots. Other experiments conducted with buckwheat in sterilized soil to which an excess of nitrogenous food was added did not develop the plants as well as where they were grown in nonsterilized soil in the presence of algæ and bacteria.

It is concluded that the fixation of elementary nitrogen through the protoplasm of the cell increases with the development of leaves and roots. Plants in a sterilized soil without nitrogen in the soil can never attain a high degree of nitrogen assimilation, and the assimilation in sterilized soil to which nitrates are added will not equal that of plants grown in nonsterilized soils. The author agrees with Frank that the assimilation of free nitrogen is a property possessed in varying degree by many phanerogams, and he claims that Hellriegel's hypothesis of assimilation through symbiosis in the root tubercles of legumes is wrong. While his experiments with buckwheat seem to indicate the possibility of assimilation of elementary nitrogen through the activity of the protoplasm of the plant, yet the author is not disposed to accede to Frank's assumption that soil bacteria have no part in the increased assimilation of free nitrogen, the author holding that they play a very important part.

The bacteriological investigations and the assimilation by algæ and bacteria are to be reported upon in a subsequent paper.

The nitrogenous constituents of young green plants of Vicia sativa, E. SCHULZE (*Landw. Vers. Stat., 46 (1895), No. 4-5, pp. 383-397*).—Leucin was found in 6-week-old plants, but amidovaleric acid and phenylalanin, which are associated with leucin in etiolated seedlings, were not found in green plants. Betäin and cholin were also separated, and the indications were that guanidin was present in small amounts. In 9-week-old plants asparagin and xanthin were present as well as betäin, and a very small amount of a base which appeared to be cholin. It appears that betäin is one of the constituents of seeds which is not utilized in germination. Cholin is present in etiolated plants in greater quantity than in ungerminated seeds, and it is suggested that it is produced by the decomposition of lecithin in the absence of light. Guanidin appears to be present in much smaller quantity in green than in etiolated plants.

Elements of botany, J. Y. BERGEN (*Boston: Ginn & Co., 1896, pp. V, 332, figs. 212*).—This book differs from most treatises on elementary botany in that it introduces a considerable amount of vegetable physiology and anatomy instead of the more usual presentation of the subject. It is intended that the plant should be studied as a factor in the struggle for existence, and the methods of observation and study advocated can not be too highly commended. A brief synoptical key and flora is appended that is designed more as illustrative of the means for identifica-

tion, this being considered subordinate to the main work, than for extended use; the more complete manuals are to be preferred for this purpose. Objection might be raised to the comparatively limited space given to the consideration of cryptogamous plants, but opinions will differ as to the advisability of giving prominence to this group of plants in such a course as is here outlined. While designed especially for high and secondary schools, this book will undoubtedly prove suggestive to almost any student of botany.

Agricultural and botanical notes in Germany and Denmark, E. HENNINGS (*Meddel. Kgl. Landbr., 4 (1895), No. 11, pp. 72*).—The author reports upon a tour of Germany and Denmark in which a study was made of various botanical facts of economic interest. A chapter is devoted to those parasitic plants and insects which are considered as most troublesome in these countries. An account is given of the methods pursued for the improvement of cultivated plants, especially through the selection of seed and choice of fertilizers. Information is given relative to the various kinds of seed used for feeding cattle and the average value of such as are used when made into cakes is tabulated.—T. HOLM.

Synopsis of North American Amarantaceæ, V, E. B. ULINE and W. L. BRAY (*Bot. Gaz., 21 (1896), No. 6, pp. 348–356*).—This is the concluding paper of the revision and contains the notes on Iresine, Celosia, Dicraurus, and Acanthochiton.

A revision of the genus Coprinus, G. MASSEE (*Ann. Bot., 10 (1896), No. 38, pp. 123–184, pls. 2*).

A synopsis of the American species of Ctenium, J. G. SMITH (*Bot. Gaz., 21 (1896), No. 6, pp. 361–364, pl. 1*).—Eight species are recognized, of which *C. glandulosum* is new.

Studies of Saprolegniaceæ, A. MAURIZIO (*Flora, 82 (1896), p. 14; abs. in Hedwigia, 35 (1896), No. 3, p. 76*).

Some anatomical characters of North American Gramineæ, T. HOLM (*Bot. Gaz., 21 (1896), No. 6, pp. 357–360, pls. 2*).—Notes are given of *Oryza sativa*.

On the structure of the pedicel of the teleutospores of Puccinia, VUILLEMIN (*Rev. Mycol., 18 (1896), No. 71, pp. 132–134*).

Concerning the mycorrhiza of Listera cordata, R. CHODAT and A. LENDNER (*Bul. Herb. Boissier, 4 (1896), No. 4, pp. 265–272, figs. 5*).

Concerning the mechanics of the curving and twining of tendrils, D. T. MACDOUGAL (*Ber. deut. bot. Ges., 14 (1896), No. 4, pp. 151–154*).

A study of the roots of certain pasture grasses, T. JAMIESON (*Ann. Agron., 22 (1896), No. 6, pp. 264–272*) —Translated from the English by J. Crochetelle.

Influence of rain and spray on the form of leaves (*Gard. Chron., ser. 3, 19 (1896), No. 495, p. 766*).—An abstract is given of the results obtained by Stahl in Java. It is shown that the tips of leaves may be lengthened by exposing them to a continual spray or stream of water.

Action of electricity on plants, C. FLAMMARION (*Bul. Min. Agr. France, 15 (1896), No. 2, pp. 282, 283*).—Plat experiments with peas and beans showed that electricity hastened flowering, improved the vigor, and increased the harvest from 20 to 28 per cent over the check plats.

Rate and mode of growth of banana leaves, W. MAXWELL (*Bot. Gaz., 21 (1896), No. 6, pp. 365–370*).

On the respiration and assimilation in cells containing chlorophyll, J. B. FARMER (*Ann. Bot., 10 (1896), No. 38, pp. 285–289*).—A report is given of experiments with Elodea in an atmosphere of hydrogen, in which it is thought the carbon dioxid is split up in the sunlight and the oxygen liberated for use by the plant.

The path of the water current in cucumber plants, E. F. SMITH (*Amer. Nat., 30 (1896), Nos. 353, pp. 372–378; 354, pp. 451–457; 355, pp. 554–562*).

Demonstration of root pressure and transpiration, S. H. VINES (*Ann. Bot., 10 (1896), No. 38, pp. 291, 292*).—The author has found that root pressure may be demonstrated by means of a Bourdon's pressure gauge.

Development and transpiration of barley under the influence of different degrees of humidity, and of the fertility of the soil, M. R. SCHRÖDER, Jr. (*Ann. Agl. Inst. Moscow, 2 (1896), No. 1, pp. 188-226; French résumé, pp. 231, 232*).

Rate of transpiration in plants, C. FLAMMARION (*Bul. Min. Agr. France, 15 (1896), No. 2, pp. 279-281*).—The rate of transpiration of the grapevine under different colored glass and of a number of plants and fruits under clear glass is given. It is shown that the rate varies with the intensity of the light and the color under which it takes place.

Researches on nuclear division in plants, II, C. DEGAGNY (*Bul. Soc. Bot. France, 43 (1896), No. 3, pp. 87-96*).

On the influence of potash and magnesium on the development and growth of Penicillium niger and other fungi, W. BENECKE (*Bot. Ztg., 54 (1896), I, No. 6, pp. 97-132*).

Chemistry of lichenic and fungus membranes, F. ESCOMBE (*Ann. Bot., 10 (1896), No. 38, pp. 293, 294*).

Concerning a phosphorus-containing substance in seed, E. SCHULZE and E. WINTERSTEIN (*Ztschr. physiol. Chem., 22 (1896), No. 1, p. 90*).—Notes are given upon a compound containing a considerable proportion of phosphorus that exists in seed of *Sinapis nigra*.

Starch in plants during the winter, O. ROSENBERG (*Bot. Centbl., 56 (1896), No. 11, pp. 337-341*).

The digestive ferment of Nepenthes, S. H. VINES (*Ann. Bot., 10 (1896), No. 38, p. 292*).—The author has repeated his experiments of 20 years ago and finds no reason to doubt the results then obtained in reference to the digestive functions of the plant.

Germinal selection, a source of variation, A. WEISSMANN (*Ueber Germinal-Selection eine Quelle bestimmt gerichteter Variation. Jena: G. Fischer, 1896, pp. 80; abs. in Bot. Centbl., 56 (1896), No. 12, pp. 380-385*).

Plant breeding, M. T. MASTERS (*Nature, 54 (1896), No. 1389, pp. 138, 139*).

Catalogue of the Sturtevant Prelinnean library of the Missouri Botanical Garden (*Reprint from Seventh Ann. Rpt. Missouri Bot. Gard., 1896, pp. 123-209*).—A catalogue of the Prelinnean works donated by Dr. E. L. Sturtevant to this garden in 1892.

FERMENTATION—BACTERIOLOGY.

Reduction of nitrates by bacteria and consequent loss of nitrogen, ELLEN H. RICHARDS and G. W. ROLFS (*Tech. Quart., 9 (1896), No. 1, pp. 40-59*).—Data are reported relating to the determination of nitrogen in different forms at different dates in 25 or more solutions, "the majority of which were so prepared as to typify the condition of water polluted with decaying organic matter and at the same time containing nitrates." These solutions were prepared by mixing fresh sewage with its purified effluent. They were as a rule low in mineral matter, free from urea, and in most cases contained a small amount of sugar. The following changes were uniformly observed in these solutions: (1) A rapid disappearance of nitrates, usually less than 10 per cent remaining at the end of 3 days; (2) a correspondingly rapid increase in nitrites, which usually reached a maximum in 2 or 3 days and then rapidly disappeared; (3) the appearance of a green growth, followed by the reappearance of nitrites; and (4) a gradual reappearance of very small quantities of nitrates. An examination of a solu-

tion which supported an unusually vigorous growth of algæ showed the following organisms:

	Per cc.
Cosmarium	44,000
Raphidium	3,100
Scenedesmus	23,000
Protococcus	42,000
Masses of Zoöglœa	2,800
Infusorium (Monas)	250

As bearing upon the question whether the organisms which effect the reduction of the nitrates can survive on purely mineral food, it was observed that in a solution containing no organic matter other than that naturally present in the water the reduction took place very slowly and incompletely.

An investigation into the nature of the food required by these organisms indicated that while milk appeared to be well adapted to them reduction proceeded very slowly in solutions to which blood had been added. An examination of the gases dissolved in the solutions and evolved during the progress of the experiment showed beyond reasonable doubt that the nitrogen which disappeared from the nitrates was finally given off in the free state. In 2 of the investigations within less than 3 per cent of the nitrogen was thus accounted for. The addition of 2 cc. of glycerin per liter of solution was found to be effective in fixing a considerable proportion of this nitrogen.

[It appears from these investigations that] "whenever nitrates are added to decomposable organic matter not sterile under such conditions that the growth of the bacteria requires more oxygen than the solution affords, the plants will take it from the nitrates, setting free nitrites which in time are decomposed, setting free nitrogen. . . . A clear understanding of these relations is of great importance to the agriculturist and especially to the sewage farmer, since it is easy to lose all the nitrogen once gained by an imprudent addition of food. In fact, to save nitrates already in the soil the sewage must be so applied that the conditions are to the highest degree favorable for contact with the air, as, for instance, in very thin layers. Aëration by the passage of air through the sewage in bulk is quite useless, however thorough the process. Again, even under the most favorable conditions it will be seen that the success of nitrogen storage is exceedingly dubious. The inference is that the most feasible way of economizing nitrogen is to feed it to the growing green plant only as fast as it can be assimilated rather than to attempt to prepare the soil in advance and risk having the element thrown back in its primal state into the atmosphere by the excretory processes of hordes of nitrogen loving bacteria. Even in spite of the aëration certain fermentative organisms seem to prefer to take their supply of oxygen from its nitrogen combinations, hence loss of nitrogen is liable to occur, if it is not inevitable, when a solution containing certain kinds of decomposing organic matter is added to a soil or water already nitrified."

In a future paper it is proposed to treat, among other topics, the fixation of nitrogen in water or soil.

On the diastase of barley, ERGOROF (*Jour. Soc. Phys. Chim., 27, p. 261; abs. in Bul. Soc. Chim. Paris, ser. 3, 15–16 (1896), No. 2, p. 202*).—This is a continuation of the author's work on diastase. A method of obtaining quite pure diastase from malt is given. The diastase was

found still to contain some mineral matter and phosphorus. The chemical characteristics were investigated. The author will continue his work on this subject.

A new classification of bacteria, W. MIGULA (*Natur. Pflanzenfamilien, 1896, No. 129; abs. in Amer. Nat., 30 (1896), No. 354, pp. 490–493*).—The classification here presented is perhaps one of the most satisfactory to the working bacteriologist yet offered.

On some Devonian bacteria, B. RENAULT (*Compt. Rend., 122 (1896), No. 21, pp. 1226, 1227*).

Concerning the organisms found in the sap of trees, F. LUDWIG (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 10–11, pp. 337–351*).—A compilation and bibliography of some of the literature is given.

On the occurrence of pathogenic bacteria in living plant tissues, K. KORNAUTH (*Centbl. Bakt. und Par. Med., 19 (1896), No. 21, pp. 801–805*).

On the morphology of bacteria, M. LÖWIT (*Centbl. Bakt. und Par. Med., 19 (1896), No. 18–19, pp. 673–686, pl. 1*).

The nature and manufacture of bacteria products, E. M. HOUGHTON (*Bul. Pharm., 10 (1896), No. 6, pp. 248–253, figs. 5*).

Concerning the origin of the Saccharomycetes, O. SEITER (*Centbl. Bakt. und Par. Allg., 2 (1896), Nos. 9, pp. 301–307; 10–11, pp. 319–321*).

Investigations concerning the supposed transformations of various Saccharomycetes, A. KLÖCKER and H. SCHIÖNNING (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 6–7, pp 185–193*).

On the relation of osmosis to the life of yeast and fermentation, E. PRIOR (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 10–11, pp. 321–336*).

Concerning the preservation of yeast in sugar solutions, J. C. HOLM (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 10–11, pp. 313–316*).

Concerning d'Arsonval's thermostat, M. MELMKOW-RASWEDENKOW (*Centbl. Bakt. und Par. Med., 19 (1896), No. 18–19, pp. 709–712, fig. 1*).

Concerning the disinfecting action of slaked lime on yeast, L. STEUBER (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 5, pp. 163, 164*).

Formalin as a disinfectant, H. STREHL (*Centbl. Bakt. und Par. Med., 19 (1896), No. 20, pp. 785–787*).

Aspergillus wentii, a new species from Java, C. WEHMER (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 5, pp. 140–150, pl. 1*).

Practical results of bacteriological researches, G. M. STERNBERG (*Pop. Sci. Monthly, 48 (1896), No. 6, pp. 735–750*).—Presidential address before the Biological Society of Washington, D. C., December 14, 1895.

The nature of toxins, A. GAUTIER (*Rev. Scient., ser. 4 (1896), No. 12, pp. 353–359*).

The action of bisulphid of carbon on certain fungi and ferments, especially the nitric ferment, J. PERRAUD (*Ann. Sci. Agron., ser. 2, (1896), 1, pp. 291–300*).

Concerning the influence of the electric current on bacteria, A. GOTTSTEIN (*Centbl. Bakt. und Par. Med., 19 (1896), No. 16–17, pp. 602–605*).

The action of electric currents of great frequency on bacterial toxins, D'ARSONVAL and CHARRIN (*Compt. Rend., 122 (1896), No. 6, pp. 280–283, fig. 1*).

Influence of the electric current on bacteria, H. FRIEDENTHAL (*Centbl. Bakt. und Par. Med., 19 (1896), No. 9–10, pp. 319–324*).—A résumé is given of the literature of this subject, all of which dates since 1890.

Vaporization of formaldehyde solutions for disinfection, A. TRILLOT (*Compt. Rend., 122 (1896), No. 8, pp. 482, 483*).

Concerning the effect of fresh air on the development of the tubercle bacillus, A. OBICI (*Centbl. Bakt. und Par. Med., 19 (1896), No. 9–10, pp. 314–319*).

Further notes upon the fats contained in the tuberculosis bacilli, E. A. DE SCHWEINITZ and M. DORSET (*Jour. Amer. Chem. Soc., 18 (1896), No. 5, pp. 449–451*).

Fermentation of uric acid by microörganisms, E. GÉRARD (*Compt. Rend., 122 (1896), No. 18, pp. 1019–1022*).

A new nitrate destroying bacillus, J. SCHIROKIKH (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 6–7, pp. 204–207*).—An account of cultures and descriptions are given of a new obligate aërobic bacillus which rapidly destroys nitrates in culture media. Its growth upon various media is described, and inoculations made with pure cultures into a bouillon containing 2.5 gm. nitrate of potash per liter destroyed all the nitrate in from 5 to 8 days at a temperature of 30 to 35° C.

Concerning a new potato bacillus which forms a dark pigment, W. BIEL (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 5, pp. 137–140*).

Contributions to the physiology of bacteria,, A. MAASSEN (*Arb. Kais. Ges., 12, pp. 390–411; abs. in Chem. Centbl., 1896, I, No. 12, p. 635*).

The reduction phenomena of bacteria and their relation to the bacteria cells, and some observations concerning reduction phenomena in sterilized bouillon, T. SMITH (*Centbl. Bakt. und Par. Med., 19 (1896), No. 6–7, pp. 181–187*).

Concerning the spore formation of Bacillus coli communis, E. PICCOLI (*Centbl. Bakt. und Par. Med., 19 (1896), No. 9–10, pp. 307–313, fig. 1*).

ZOÖLOGY.

The varying hare, or white rabbit, B. H. WARREN (*Pennsylvania Sta. Rpt. 1894, pp. 291–298, pls. 2*).—This includes a description and notes on the habits of *Lepus americanus virginianus*. It is stated that this hare rarely if ever visits cultivated lands or gardens, but frequents dense hemlock forests and laurel and other thickets, where it is nocturnal and feeds upon grasses, leaves, buds, and berries. In the winter it eats the twigs and bark of shrubs and small trees, and its fur changes from reddish brown to white. It does not burrow, as do some other species, but lives under fallen tree tops and in dense thickets, where the young, 4 to 6 in number, are born in May. Frequently 2 litters are produced in a season.

Observations on the presence and habits of the white hare are included from various persons in different parts of the State, from which it appears that the species is found chiefly in the mountain regions of the northern, central, and eastern portions of Pennsylvania. Two colored plates illustrate the winter and summer pelage.

Exterminating woodchucks, W. BROWN (*Cult. and Country Gent., 6 (1896), No. 2254, p. 284*).—The writer recommends destroying the winter quarters of the animals; also putting woolen rags saturated with a tablespoonful of bisulphid of carbon in the hole as far as can conveniently be done and covering the mouth of the hole. This must be done systematically and for a long period. The author succeeded in greatly reducing the numbers in 2 seasons.

Concerning the use of bacteria for destroying mice (*Deut. landw. Presse, 23 (1896), No. 25, p. 219*).

METEOROLOGY.

On the influence of carbonic acid in the air upon the temperature of the ground, S. ARRHENIUS (*Phil. Mag. and Jour. Sci., 1896, Apr., pp. 237–276*).—It is well known that the atmosphere exerts a selective action on the heat rays. This influence is exerted not by the chief mass

of the air, but "in a high degree by aqueous vapor and carbonic acid, which are present in the air in small quantities." It is comparatively small on the heat of the sun, but is marked on the transmission of rays from the earth. Data furnished by Langley's studies on "The Temperature of the Moon," by observations by Paschen[1] and Ångström,[2] and by Buchan's[3] temperature charts are made the basis of calculations which show "the mean alteration of temperature that would follow if the quantity of carbonic acid varied from its present mean value,[1] to another, viz, to 0.67, 1.5, 2, 2.5, and 3, respectively. This calculation is made for every tenth parallel [between 60° S. and 70° N.] and separately for the four seasons of the year," and indicates that "if the quantity of carbonic acid increases in geometric progression the augmentation of temperature will increase nearly in arithmetic progression."

The seven-day weather period, H. H. CLAYTON (*Amer. Jour. Sci., 1896, No. 7, pp. 7-16, figs. 3*).—In a previous paper[4] the author has presented data to show the existence of periods or rythms in the weather in the United States. In the present article the investigation is extended to other countries.

Three stations were selected in the Arctic region (Point Barrow, Fort Conger, and Exholm), 4 in the United States (Roseburg, Cheyenne, Chicago, and Blue Hill), 5 in Europe (Perpignan, Lesina, Bucharest, Christiania, and St. Petersburg), 2 in Asia (Zi Ka Wei and Tokio), 2 in Oceanica near the equator (Manila and Batavia), 3 in middle South America (Matanzas, Corrientes, and Rio Janeiro), 1 in Mauritius, and 1 in Australia (Flagstaff).

"The work embraced the investigation of a weather period of 7 days 6.43 hours, another of 6 days 3.95 hours, and a third of 5 days 10.8 hours. The methods and results were in each case similar, and it is deemed necessary to recite in detail only those obtained for the first period. Beginning with January, 1880, an ephemeris was constructed for the 15 years ending with January 6, 11 7 p. m., 1896, which may be taken as the epoch. For each of the selected stations, during the entire time covered by available observations, the number of barometric minima which occurred on each day of the 7-day period was counted. The first day consisted of the first 24 hours following the dates of the ephemeris, the second day consisted of the succeeding 24 hours, and so on for the 7 days, the final quarter day being omitted. The number of barometric minima occurring on each day was selected because it is generally recognized by meteorologists that rain, temperature changes, etc., cluster around the barometric minima, and any periodicity discoverable in these minima implies a periodicity in all the other weather changes."

The results are reported in tables and diagrams. It appears that there are 2 maxima and 2 minima of frequency during the 7-day period, and at some stations 3.

The results show also "that all over the world the days of the period on which the maximum frequency of barometric minima occurs at any

[1] Weid Ann., 1893, p. 409; 1894, pp. 209, 334.

[2] Bihang K. vet. Akad. Handlingar, 15 (1889), No. 9, p. 15. Ofversight K. vet. Akad. Fördhandl., 1889, No. 9, p. 553.

[3] Rpt. on the Scientific Results of the Voyage of H. M. S. Challenger; Phys. and Chem., 2 (1889).

[4] Amer. Jour. Sci., 1894, Mar.; Amer. Met. Jour., 11 (1895), p. 376 (E. S. R., 6, p. 898).

station tend to remain the same at that station during succeeding years." Data from adjacent stations indicate "that the days of maximum frequency occurred first at higher latitudes and at western stations, indicating that the periodicity was connected with barometric waves which swept from the poles toward the equator and from west to east, or in other words, from the northwest."

An examination of the data for the different seasons of the year makes it apparent that there is a tendency for the days of maximum frequency to remain the same throughout the year, but there is considerable irregularity in this respect. With 1 or 2 minor exceptions, the greatest frequency of barometric maxima appears to be about halfway between the barometric minima.

"To ascertain to what extent the period would show itself in short intervals, the periods were separated into groups of 11 periods occupying about 11 weeks each and the barometer observations taken 3 times a day at Blue Hill Observatory were averaged for each 8 hours of the period from 1890 to 1895." These data show that the chief minimum remained persistent on the seventh day, while the secondary minimum shifted from the beginning of the fourth day in winter to the end of the second day in summer, and toward the end of summer showed a double minimum, one on the second and the other on the fourth day. In autumn and early winter the minima are again on the fourth and seventh day, thus showing that during the short intervals the lowest pressure occurred on the same days of the period as the greatest frequency of barometric minima during the 10 years' observation. An examination of temperature observation shows that "the greatest plus departures [occur] on the third and sixth day, or about one day preceding the lowest minimum barometric pressures, with the extremes of the temperature and pressure departures on the sixth and seventh day, respectively."

The importance of this work in weather forecasting is suggested by the fact that the results already obtained make it "possible to say that in all parts of the world barometric minima will be from 10 to 20 per cent more frequent on certain days than on certain other days, provided the interval taken is sufficiently long. It is also possible to say that certain days will average colder than other days. I think even this information would prove of value to certain industries, and I have an abiding faith that it is only the beginning of the science of weather forecasting which is yet to come."

The principal results of the last high ascension of the balloon Aërophile, March 22, 1895, G. HERMITES and G. BESANÇON (*Compt. Rend., 122 (1896), No. 15, pp. 849, 850*).—The ascension was begun at 11.30 a. m. in a clear air. The balloon rose very rapidly (5 to 6 meters per second), attaining a maximum height of 14,000 meters. The minimum temperature recorded was −63° C. The temperature at the surface of the earth was 14° C. The fall in temperature was therefore 1° for each 182 meters.

Meteorological records, 1889–1895 (*Illinois Sta. Bul. 41, p. 148*).—A tabular record of the maximum, minimum, and average monthly temperature and of the monthly and yearly rainfall is given. The maximum temperature for the whole period was 99° F. (in August, 1891 and 1894) and the minimum —21° (in January, 1894). The average rainfall for the period was 31.16 in.

Meteorological observations at Massachusetts Hatch Station, January–March, 1896, L. METCALF, C. A. KING, and J. L. BARTLETT (*Massachusetts Hatch Sta. Met. Buls. 85, 86, and 87, pp. 4 each*).—These bulletins include notes on the weather and the usual summaries of observations at the meteorological observatory of the station.

Observations, R. C. KEDZIE (*Michigan Sta. Rpt. 1894, pp. 94–121*).—A record of daily observations on sunshine, a summary of readings during 8 years of the temperature of the water in a river running through the college grounds, and the usual detailed daily and monthly summaries of observations on air pressure, temperature, humidity, wind movement, precipitation, etc.

Meteorological observations at Pennsylvania Station, W. S. SWEETSER (*Pennsylvania Sta. Rpt. 1894, pp. 299–303, 309–329*).—The meteorological work of the station in 1894 was "merely a continuation of the work of preceding years, including the observations usually called for by the United States Weather Bureau, upon atmospheric conditions, and also observations upon soil temperature at various depths, and the daily duration of sunshine." (E. S. R., 6, p. 701.) Monthly summaries of observations are given in the body of the report, and the detailed record in an appendix.

Statistics of State Weather Services, O. L. FASSIG (*U. S. Dept. Agr., Weather Bureau, pp. 12*).—"The entire domain of the United States, with the exception of Alaska, is now covered by organized State or Territorial services under the joint control of the National Weather Service and the respective States and Territories The complete system at present includes about 3,000 observing stations at which the ordinary elements of the weather are regularly recorded, and published from month to month." The pamphlet gives the main facts, in condensed form, relating to the organization, history, and publications of the various State Weather Services.

Climate and Health, W. L. MOORE and W. F. R. PHILLIPS (*U. S. Dept. Agr., Weather Bureau, Climate and Health, 1 (1895), Nos. 2, pp. 27–58, charts 25; 3, pp. 59–82, charts 20; 4, pp. 83–107, charts 20; 5, pp. 109–145, charts 21; 6, pp. 147–174, charts 12*).—These numbers contain the usual monthly summaries of climatologic, morbidity, and mortality reports, with maps and charts showing the principal features of these reports during the periods covered. In addition to these summaries with their accompanying explanations, Nos. 2 and 3 contain short notes on meteorology and the public health, and Nos. 1 and 5 on progress in medical climatology. The climatologic statistics are taken from reports of the regular stations of the Weather Bureau, and the morbidity and mortality statistics from special reports contributed by physicians and health officers directly to the Weather Bureau.

Meteorological conditions in Denmark, 1894–'95, V. WILLAUME-JAUTZEN (*Tidsskr. Landökon., 15 (1896), pp. 195–214*).

SOILS.

Concerning the significance of plant and soil analysis in estimating the quality of soils, Z. JANUSZOWSKI (*Inaug. Dis. Leipzig, 1895, pp. 60; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 76, 77*).—From the results of experiments carried out in the government of Plock in Poland in the autumn of 1893 the following conclusions are drawn:

The analysis of the grain grown on soil well supplied with all fertilizing constituents shows little difference in the percentages of each ingre-

dient. The application of a fertilizing constituent on a soil in which it is deficient resulted in an increase of this constituent in the plant, but this effect was masked by the simultaneous application of other fertilizing constituents. For instance, the application of phosphoric acid to a soil deficient in that element was followed by a considerable increase of phosphoric acid in the grain grown on the soil, provided the application of phosphoric acid was not accompanied by liberal manuring with nitrogen. The analysis of the plant may, therefore, be misleading, since a low phosphoric acid content, for instance, may be due not to the deficiency of that element in the soil, but to an excess of nitrogen or potash. It may be assumed, however, that when the addition of any fertilizing constituent does not increase the percentage of that substance in the plant the soil contains a sufficient amount of that constituent, and *vice versa*.

Plant analysis is a perfectly reliable means of determining the fertilizer requirements of soils only when made in connection with field experiments with fertilizers. In many cases, however, such analysis may give valuable indications without fertilizer experiments. When, for instance, a given constituent is found in the plant in maximum quantity it is safe to assume that this element is not deficient in the soil, and if the constituent is found in minimum amount the indications are that this constituent is either deficient in the soil or is associated with an excess of the other constituents.

Nitrification in soils, R. BURRI and A. STUTZER (*Centbl. Bakt. und Par. Allg.*, *2* (*1896*), *No. 6-7*, *pp. 196-201*, *pl. 1*).—In experiments with organisms derived from soils it was observed that in all cultures in which ammonia salts were oxidized to nitrites there was found a coccus-like organism which showed a close resemblance to Winogradsky's *Nitrosomas europaea*. It was impossible, however, to secure pure cultures of this organism by means of silicic acid plates.

Observations on impure cultures in mineral media showed that there was a difference in oxidizing power in organisms derived from different sources, there being 5 classes from Germany and 1 from Africa thus distinguished.

An organism which formed nitrates was isolated from a sample of soil obtained from Northeim. This organism appeared to be identical with that isolated by Winogradsky from Quito soil. It flourished on organic food—nutrient gelatin—but in this medium it did not oxidize nitrites, and when transferred to a mineral medium it appeared to have lost the oxidizing power, for only in once instance was any nitrate formed.

Comparative experiments with the nitric organism derived from soils in different localities showed no essential difference in physiological action.

Cultures in which the nitrous and nitric ferments were mixed showed the same reactions which occur in soils, namely, that ammonia salts

were converted directly into nitrates without the intermediate formation of nitrites.

The soil of the Lancaster County, Pennsylvania, limestone belt in its relation to tobacco culture, W. FREAR (*Pennsylvania Sta. Rpt. 1891, pp. 121–168, 357–363, map 1, pls. 3, dgms. 2*).—This article includes a general discussion of the functions of soils with relation to plant growth, brief descriptions of the more important tobacco-producing regions of the world, and physical and chemical examinations of the soil of the plats at Donegal and Rocky Spring, Lancaster County, on which experiments with tobacco are in progress. The physical and climatic studies were carried out with the coöperation of M. Whitney, of this Department.

"The plan involved (1) the mechanical analysis of the soils of Rocky Spring and Donegal;[1] (2) the study of the meteorological conditions during the growth of the crop; (*a*) the rainfall: (*b*) the atmospheric temperature; (*c*) the radiation of heat from the earth; (*d*) the temperature of the soil; (*e*) the moisture of the soil. The mechanical analysis of the soil was carried on by the method known as Osborne's beaker method."

For purposes of comparison the results obtained in these studies are accompanied by those furnished by similar studies of typical tobacco soils of Massachusetts (Hatfield), Connecticut (Hartford and Poquonock), and North Carolina (Granville), and of wheat soils of Maryland (Frederick and Hagerstown valleys). Classifying these soils according to the proportion of the different sized particles which they contain, the following rough grouping is obtained:

"(1) Those composed chiefly of medium, fine, and very fine sand: The good tobacco soil of Granville County, North Carolina; the "plains" land, East Hartford, Connecticut; the soil at Poquonock, Connecticut

"(2) Those chiefly composed of very fine sand and silt: The Podunk soil, Connecticut; the interior Granville County soil, North Carolina: the Hatfield soil, Massachusetts, and the Rocky Spring soil, Pennsylvania: the last-named soil is more largely composed of silt, the others of fine sand.

"(3) Those composed chiefly of very fine silt and clay: The tobacco soils of Donegal and Lititz, Lancaster County, Pennsylvania, and the heavy wheat soils of Frederick and Hagerstown, Maryland. The latter soils considerably exceed the Lancaster County soils in the percentage of clay."

The soil temperature observations are very incomplete, but indicate that the Rocky Spring (Pennsylvania) soil is more favorable, as regards temperature, to the growth of tobacco than that of Connecticut (Poquonock), the daily range being 5.5° less.

As regards average percentage of soil moisture, the various soils for which data are compiled may be grouped as follows:

"From 19.5 to 22 per cent, South Deerfield and Hatfield, Mass.; from 14.5 to 17 per cent, Donegal, South Granby, East Hartford, and Rocky Spring; from 9.5 to 11.5 per cent, Cana, Windsor, Bloomfield, and Saxon; 7.5 per cent, Poquonock, both soils. . . .

[1] To these were added samples of soil from Lititz, also in the limestone belt.

"Considering simply the variations in soil moisture from June 17 to July 7, the following group is indicated: Ten to 13 per cent, South Deerfield and Rocky Spring; 7 to 8.5 per cent, South Granby, Hatfield, Cana; 3.5 to 6 per cent, Donegal, Bloomfield, Windsor, Saxon; 1.5 to 2.5 per cent, East Hartford and the Poquonock soils.

"Considering the whole season, the grouping of these localities for which we have data would be: Eighteen to 19 per cent, Rocky Spring; 8.5 to 10 per cent, East Hartford, Bloomfield, Donegal; 5 to 7 per cent, Windsor and Poquonock.

"The Rocky Spring soil is seen to be subject to wide variations in the percentage of moisture at different dates, and the tobacco growing upon it would probably suffer somewhat in texture because of the inequality in this highly influential condition of growth.

"The Donegal soil is, however, not different in this respect from a number of the best tobacco soils of the Connecticut Valley."

As Sachs has shown, the amount of water which a soil contains is not always an exact index of the quantity which it will yield to the plant. Clays and humus soils yield up a much smaller proportion of their water to plants than sand.

"It is entirely possible, from these facts, that owing to the fineness of its pores and its light weight, the Donegal soil may, despite its much larger percentage of water, yield little more to the tobacco crop growing upon it than does the soil at Poquonock."

Determinations of the water-holding capacity of the 2 Pennsylvania soils give the following results: Rocky Spring surface soil, 50 per cent; subsoil, 45 per cent; Donegal surface soil, 50 per cent; subsoil, 52 per cent.

The amounts of water which the soils absorbed from a saturated atmosphere in 24 hours at about 16° C. were: Rocky Spring soil, 3.09 per cent; subsoil, 3.09 per cent; Donegal soil, 3.25 per cent; subsoil, 3 per cent.

Chemical analyses by J. A. Fries and M. E. McDonnell of the Pennsylvania soils, using the "official method," supplemented by the Dyer citric-acid extraction method, are reported with similar analyses of other typical tobacco soils, as follows:

Percentage composition of tobacco soils (air-dry).

	Donegal.		Rocky Spring		New Milford, Conn	Granville County, N. C.	Gray soil of Sumatra.	Chernoziom from Poltava.
	Surface soil.	Subsoil.	Surface soil	Subsoil				
Moisture	2.420	2.220	2.210	1.860	1.820	0.670	4.45	6.77
Humus (loss on ignition)	4.880	4.750	4.780	2.640	6.860	1.210	9.10	13.62
Nitrogen	.110	.094	...	.052	......	......	......	......
Insoluble (sand, etc.)	67.540	66.770	71.490	71.020	77.290	95.500	52.31	54.14
Soluble silica	11.820	11.730	8.500	10.490	4.370	.910	15.35	12.87
Dissolved by hydrochloric acid:								
Potash	.620	.670	.670	.560	.230	020	22	.67
Soda	Trace	Trace	.130	.110	.010	.004	.54	.04
Lime	.610	.620	.410	.250	320	.070	.77	1.21
Magnesia	1.260	1.190	2.050	1.930	.780	.020	.37	.65
Brown oxid of manganese	.050	.050	.055	.050	.017	.040	.45	.12
Peroxid of iron	4.130	4.300	4.280	4.870	3.530	.390	4.43	9.68
Alumina	6.570	8.000	6.550	7.460	4.770	.830	10.33	
Phosphoric acid	.191	.177	.265	.180	.220	.020	.11	.16
Sulphuric acid	.373	.428	.290	.190	.070	.014	.05	.08
Soluble in 1 per cent citric acid:								
Potash	.053	.064	.037	.010	......	......	......	......
Phosphoric acid	.054	.042	.123	.055	......	......	......	......

"The Donegal surface soil is deeper than that at Rocky Spring, the subsoil in the former case showing at nearly all important points as great fertility as the surface soil. At Rocky Spring the surface soil was much richer than the subsoil in the more important plant foods

"The humus content of the Rocky Spring soil was as great [as that of the Donegal soil] down to the true subsoil [but this contained only a little more than half as much humus as the surface soil].

"The nitrogen supply at Rocky Spring was probably as high if not higher than that of the surface soil at Donegal, but in the subsoil it maintained a similar relation to the humus and was, therefore, only half as great as in the Donegal subsoil. . . .

"As the mechanical analyses would indicate, the insoluble matter (sand, etc.) is several per cent higher in the Rocky Spring soil.

"As to the matter soluble in hydrochloric acid, the soils are very similar as regards their content in iron, alumina, manganese, and potash; the Rocky Spring soil contains much more magnesia—over one-half more than the Donegal soil—more soda, and somewhat more phosphoric acid, particularly in the upper 6 in. of soil, where the phosphoric acid tends to accumulate; on the other hand, the soil of the latter locality is one-half richer in lime and considerably richer in sulphuric acid and soluble silica.

"Water extracts show the Rocky Spring soil to contain 3 to 5 times as much soluble sulphates, but barely one-twentieth as much chlorin as that of Donegal.

"The citric acid extracts indicate that the Donegal soil has from 1.5 to 6 times as much readily available potash as the Rocky Spring soil, but that the surface soil of the latter has 3 times as much available phosphoric acid as the Donegal surface soil. This is very interesting in view of the general belief, quoted last year, that the soil about Rocky Spring is not nearly as responsive to treatment with phosphatic fertilizers as that near Donegal"

A comparison of the results of analyses of a number of typical tobacco soils, including those of the Chernoziom district of Russia, of Sumatra, Java, Cuba, Brazil, Massachusetts, Connecticut, and North Carolina leads to the conclusion that, "despite the general impression that the best tobacco is grown only upon soil rich in organic matter, provided a proper soil texture and plant food supply be otherwise secured—a proviso shown by repeated experience to be entirely possible—the tobacco crop is practically independent of the presence of natural humus in the soil."

These analyses further indicate that the inferior quality of the tobacco grown in certain clayey soils is not due to the oxid of iron which they contain.

Summarizing briefly, it is claimed that "the results of these investigations show the Lancaster County soils to be of a heavier, more clayey type than the best wrapper-leaf soils of other districts and to be somewhat more moist than the average of such soils. So far as examined, however, they are not cooler, but warmer and more equable in temperature. In fertility they are not conspicuously lacking, being, as a whole, rather rich than poor; nor do injurious constituents appear in excessive proportion."

The agricultural possibilities of Douglas County and Northwest Wisconsin, F. H. KING (*Wisconsin Sta. Bul. 43, pp. 7–26, figs. 5*).—This is a report of the results of a 5 days' study of the soils of this

region during July, 1894, supplemented by "facts and data gathered by other observers applicable to the region," with recommendations and suggestions concerning the clearing of the land, the management of the soil, suitable crops, etc.

Four strongly contrasted types of soil are found here: (1) A heavy red clay, (2) a light clay loam, (3) a sandy loam shading into a sandy soil, and (4) a swamp or humus soil. The origin, characteristics, adaptabilities, and management of each are discussed, compiled chemical analyses of the first being given. Notes and tabulated data are also given on the water supply and climate of the region. The results of observations of the temperature of the soil on 7 different days in July and August at depths of 1, 2, and 3 ft. showed—

"that there is an appreciable though not large difference between the temperatures of the soil in the Superior district and those at Madison and at Oshkosh. Even as far south as Freehold, New Jersey, where soil temperatures were taken on August 18, the soil was there only about 3° F. warmer than at Poplar 19 days earlier. So far, therefore, as the temperature of the soil is concerned, at least for the summer season, the agricultural prospects of the Superior district are favorable."

Hawaiian soils, W. MAXWELL and J. T. CRAWLEY (*Rpts. Hawaiian Expt. Sta. and Lab., 1895, pp. 3-19*).—The general characteristics of Hawaiian soils are discussed and the averages of analyses of 45 samples of soil from sugar plantations on the different islands of the Hawaiian group are reported as follows:

Average composition of Hawaiian soils.

Island	Lime.	Potash.	Phosphoric acid	Nitrogen.
	Per cent	*Per cent*	*Per cent*	*Per cent.*
Oahu	0.380	0.342	0.207	0.176
Kauai	.418	.309	.187	.227
Maui	.395	.357	.270	.388
Average	.398	.336	.221	.260

These soils are divided into 2 classes, (1) Makai soils, or those of the lowlands, and (2) Mauka soils, or those of the uplands. The variations in the chemical composition and mechanical condition of these classes are shown in the following table:

The composition and mechanical condition of Hawaiian soils of different classes.

	Lime.	Potash.	Phosphoric acid.	Nitrogen.	Fine earth.	Coarse earth.
	Per cent.	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*	*Per cent.*
Makai soils:						
Virgin	0.460	0.367	....	0.215	89.6	10.4
Cropped	.485	.335	....	.237	88.3	11.7
Average	.474	.328	0.213	.176	89.1	10.9
Mauka soils:						
Virgin	.415	.324	.248	.530	82.0	18.0
Cropped	.248	.270	.243	.451	78.2	21.8
Average	.268	.332	.238	.401	80.1	19.9

Water supply considered principally from a sanitary standpoint, W. P. MASON (*New York: John Wiley & Sons, 1896*).

Phosphoric acid in ferruginous soils, CARRÉ (*Ind. Lait., 21 (1896), No. 26, pp. 203, 204*).

Bare fallow, P. P. DEHÉRAIN (*Ann. Agron., 22 (1896), No. 6, pp. 257–263*).

Report of marsh culture experiments during 1894, C. G. EGGERTY (*Kgl. Landt. Akad. Handl. Tidskr., 35 (1896), pp. 34–45*).

On the cultivation of high marshes, T. WESTH (*Landmansblade, 28 (1895), pp. 788–790*).

Observations on soil temperature and moisture, W. S. SWEETSER (*Pennsylvania Sta. Rpt. 1894, pp. 330–353*).—A record is given of tridaily observations at the station during 1894, with thermometers at depths of from 1 to 24 in.

FERTILIZERS.

Are nitrates indispensable to the growth of plants? O. PITSCH and J. VON HAARST (*Landw. Vers. Stat., 46 (1895), No. 1–5, pp. 357–370*).—This is a continuation of previous experiments.[1] The soil used in the experiments was sterilized and freed from nitrates. In 1892 wheat was grown in such soil containing 0.105 per cent of nitrogen without addition of nitrogen, and in the same soil with addition of amounts of ammonium sulphate corresponding to 1.05 gm. and 0.53 gm. of nitrogen and of sodium nitrate furnishing 1.05 gm. of nitrogen. With the larger amount of ammonium sulphate the total yield, grain and straw, was less than when no nitrogen was applied, and with the smaller amount about the same, while with nitrate the yield was largely increased. In similar experiments in 1893 with oats the nitrate again demonstrated its superiority to the ammonium salts. The effect of the ammonium sulphate was considerably increased by the addition of potassium and sodium chlorid, the yield being practically the same with the larger and smaller amounts of ammonium sulphate.

The assimilation of potash insoluble in hydrochloric acid, but separated out by hydrofluoric acid (*Rev. Agron. Louvain, 4 (1896), No. 4, pp. 330–333*).—Investigations by a number of experimenters are reported to show that soils (especially sands) which yield only traces of potash on digestion with hydrochloric acid, but considerable amounts when treated with hydrofluoric acid, may produce as good crops of potatoes, oats, and other plants with a fertilizer lacking in potash as with one containing this element. The results in general indicate that certain plants are capable of utilizing soil potash which is insoluble in hydrochloric acid.

The absorbent power for water which some fertilizers give to soil, N. PASSERINI (*Staz. Sper. Agr. Ital., 28 (1895), No. 12, pp. 721–732; abs. in Chem. Centbl., 1886, I, No. 12, p. 661*).—Glass dishes containing 100 gm. of soil, and having a superficial area of 33.17 sq. cm., were used in these experiments. One series of dishes received no fertilizing

[1] Landw. Vers. Stat., 42 (1892), p. 1 et seq.

material, another 1 gm. of nitrate of soda per dish, a third 1 gm. of monocalcium phosphate, a fourth 1 gm. of muriate of potash. The soil used contained 10.9 per cent of particles larger than 5 mm. in diameter, 4.9 per cent larger than 1 mm., and 84.2 per cent fine earth. The fine earth contained hygroscopic water 1.85 per cent, organic and volatile matter 3.32 per cent, siliceous matter 83.83 per cent, carbonate of lime 0.32 per cent, clay 10.33 per cent, undetermined and lost 0.35 per cent. The dishes were exposed to the elements, but protected from the introduction of all foreign substances except water and gases, from June 27 to August 28, 1894, weighings being made twice each day. The results show that the amount of hygroscopic moisture absorbed or given off by the soil depends principally upon the temperature and the humidity of the air, but that it may be materially affected by the fertilizer applied to the soil. Nitrate of soda almost always increased the water absorbed by the soil, while muriate of potash seemed to have little effect, and monocalcium phosphate none at all. It is suggested that muriate of potash might be more effective in this regard on soils rich in lime, and that the superphosphate of commerce, which contains both sulphate of calcium and free sulphuric acid, might materially increase the absorbent power of soil for water.

In a second experiment, extending from August 30 to September 4, to compare sulphate of ammonia and nitrate of soda, the results indicate that sulphate of ammonia is without marked effect upon the absorbent properties of the soil.

The best preservatives for liquid manures, VAN ERMENGEN (*Ztschr. Pflanzenkrank., 6 (1896), No. 1, pp. 53, 51*).—From comparative tests of the effectiveness of caustic lime, limewater, chlorid of lime, carbolic acid, creolin, and sulphites and sulphates (of copper and zinc) in preventing the growth of the organisms which produce destructive fermentations in manure, it is concluded that zinc sulphate is best suited for use as a manure preservative when both economy and effectiveness are considered. The sulphites were slightly more effective than the sulphates, but their expensiveness precludes their general use.

The agricultural value of bone meal (*Massachusetts Hatch Sta. Bul. 35, pp. 24*).—This is a summary by C. Wellington, principally of the results of pot experiments by Wagner[1] at Darmstadt, Germany, during three years, on clay soil, with rye and clover, and by Steffek and Märcker[2] at Halle, Germany, during four years, on sandy and loam soils containing variable amounts of phosphoric acid, with barley, rye, mustard, vetch and oats, and peas. The data are given in considerable detail, and "are believed to offer sufficient proof of the following statements:"

"(1) The superior value which has hitherto been accorded to undissolved bone meal as a fertilizer is due solely to the nitrogen which it contains.

[1] Die rationelle Düngung, Darmstadt, 1891.

[2] Ueber die Phosphorsäure Wirkung der Knochenmehle, Berlin, 1895.

"(2) Undissolved bone meal as a phosphate fertilizer is no more valuable than are the raw mineral phosphates.

"(3) Hereafter it must be classed with the latter rather than with high-grade phosphates containing available phosphoric acid.

"(4) As a phosphate fertilizer it yields no better results than mineral phosphates, whether tried alone or with superphosphate, on loams or sandy soils, on soils rich or very poor in phosphoric acid, whether with grains or with turnips, mustard, or other cruciferous plants, either in the first or in succeeding crops.

"(5) The various kinds of bone meal show no essential difference in these results.

"(6) The best form in which to apply bone meal is as 'dissolved bone meal,' *i. e.*, mixed with 60-degree sulphuric acid, at the rate of 20 per cent for raw and 40 per cent for glue-free bone meal.

"(7) For stocking land with a supply of phosphoric acid, 'dissolved bone meal' is better adapted than is superphosphate."

Inspection of fertilizers in Maine, W. H. JORDAN, J. M. BARTLETT, and L. H. MERRILL (*Maine Sta. Bul. 22, 2d ser., pp. 20*).—Notes on the work of the fertilizer control in Maine and on valuation of fertilizers, with tabulated analyses of 88 samples of fertilizers examined during 1895. Bulletin 18 of the station (E. S. R., 7, p. 111) gave the results of analyses of manufacturers' samples examined during this year. The present bulletin is devoted almost entirely to analyses of samples selected by a station representative at different points in the State from goods which were offered for sale. A summary of the results of analyses of 57 brands is given as follows:

"(1) The averages for nitrogen are: Guaranty, 1.99 per cent; manufacturer's sample, 2.14 per cent; station sample, 2.09 per cent. For available phosphoric acid the averages are: Guaranty, 7.84 per cent; manufacturer's sample, 9.05 per cent; station sample, 8.58 per cent. For potash: Guaranty. 3.31 per cent; manufacturer's sample, 3.60 per cent; station sample, 3.12 per cent.

"(2) In the 57 brands the station sample, as compared with the manufacturer's sample, was in nitrogen practically the same 23 times, poorer 22 times, and better 12 times; in available phosphoric acid, practically the same 14 times, poorer 31 times, and better 12 times; in potash, practically the same 16 times, poorer 24 times, and better 17 times.

"(3) Comparing the station sample with the minimum guaranty, the station sample was, in nitrogen, practically the same 27 times, poorer 9 times, better 21 times; in available phosphoric acid, practically the same 20 times, poorer 7 times, better 30 times; in potash, practically the same 17 times, poorer 14 times, and better 26 times."

As a rule, the fertilizers sold in the State were well up to the minimum guaranty.

Analyses of fertilizers, E. B. VOORHEES, L. A. VOORHEES, and J. P. STREET (*New Jersey Stas. Bul. 113, pp. 72*).—This bulletin gives discussion and data relating to trade values of fertilizing ingredients in 1895 and the average cost per pound of fertilizing constituents, and analyses and valuations of 576 samples of fertilizing materials, including factory-mixed and home-mixed fertilizers, nitrate of soda, dried blood, dried and ground fish, hoof meal, tankage, bone, acid phosphate, muriate of potash, sulphate of potash, kainit, and wood ashes.

"The average composition, selling price, and commercial valuation per ton of all the brands of mixed fertilizers examined in 1891, 1892, 1893, 1894, and 1895, as well

as the percentage difference between valuation and selling price, or the charges for mixing, bagging, and selling, are shown in the following tabulation:

Composition, selling price, and valuation of mixed fertilizers.

	Total nitrogen	Total phosphoric acid.	Available phosphoric acid.	Insoluble phosphoric acid.	Potash.	Selling price.	Station valuation.	Percentage difference.
	Per cent.	*Per cent.*	*Per cent*	*Per cent*	*Per cent.*			
1891	2.71	10.12	7.29	2.83	4.21	$34.23	$25.31	35.2
1892	2.74	10.38	7.70	2.67	4.59	34.19	25.66	33.2
1893	2.69	10.23	7.54	2.69	4.58	34.11	24.41	39.7
1894	2.87	10.40	7.37	3.03	4.94	34.17	24.83	37.6
1895	2.80	10.74	7.84	2.90	4.80	32.87	24.15	36.1

"[An examination of the home mixtures shows that] plant-food, costing the farmer $28.62 per ton when mixed at home, is worth at station valuation $31.68, and costs on the average in commercial mixtures $43.12.

"The home mixtures examined represent the purchase of over 1,000 tons. At the rate here indicated there has been a saving of $11,500, certainly a good return for cash payments instead of credit, for selecting materials high-grade and suited to the needs of the soil and plant, instead of buying hit or miss, and for using the regular labor of the farm in mixing instead of paying others who do the work no better."

The food of crops and how to apply it, C. M. AIKMAN (*London: Vinton & Co., Ltd., 1895, pp. 88*).—"This little work is intended as a guide to the elementary principles involved in the application of fertilizers. It does not in any sense claim to be a treatise on the subject of manures and may be regarded as forming an introductory text-book to the author's manual on 'Manures and Manuring.' It is hoped that the elementary facts of agricultural chemistry necessary for an intelligent comprehension of the subject are stated in such a way that readers unacquainted with natural science will have no difficulty in mastering them. In the hope that the book may prove itself to be suitable for use in rural schools where agricultural science is taught, a number of questions have been added as an appendix." The book is divided into 12 chapters as follows: Sources of plant food; how plants feed; the nature and function of fertilizers; farmyard manure and sewage; guano; nitrate of soda, sulphate of ammonia, and other nitrogenous fertilizers; bones; superphosphate and mineral phosphates; potash fertilizers; indirect manures; the composition and application of fertilizers, and the manuring of the common farm crops.

Analyses of commercial fertilizers, H. J. WHEELER, B. L. HARTWELL, and C. L. SARGENT (*Rhode Island Sta. Bul. 34, pp. 83–87*).—Analyses and valuations of 10 samples of fertilizers are reported, with explanatory notes and a tabular statement showing the number of complete fertilizers analyzed during 5 years (1891–'95) and the agreement of the analyses with the guaranties.

Home-mixed fertilizers, H. J. WHEELER and B. L. HARTWELL (*Rhode Island Sta. Bul. 34, pp. 88–125*).—This is a summary of the results of the experience of progressive farmers in home mixing, with a discussion of the preparation and use of home-mixed fertilizers under the following heads: Opinions in relation to the advantages of home mixing; how to buy chemicals and other fertilizer stock; how to mix fertilizers; the cost of mixing; can the farmer mix in a satisfactory manner? how shall the special needs of soils be determined? tests for acidity; test with beets and lime; practical test for a deficiency of potash, phosphoric acid, and nitrogen; in relation to special fertilizers for special crops; fertilizer formulas for various crops; on the effect of wood ashes as a fertilizer and the supplementary constituents which should be used in connection with them; seaweed and the supplementary fertilizers which it requires; and barnyard manure and the supplementary fertilizers which it requires.

Macomber's machine for the home mixing of fertilizers, C. O. FLAGG (*Rhode Island Sta. Bul. 34, pp. 126–128, pls. 2, fig. 1*).—An illustrated description is given of

a contrivance devised by E. G. Macomber, of Portsmouth, Rhode Island, "and used by him with perfect satisfaction for 4 years in the home mixing of fertilizers. By its use chemicals and fertilizers of various kinds are thoroughly mixed at a cost of about 50 cts. per ton. Fine ground bone and other dusty materials can be perfectly mixed without raising clouds of dust, as is the case in mixing them with shovels on the barn floor." The mixer is a revolving octagonal churn-like box, capable of mixing 500 lbs. of fertilizer in each charge, and requiring 1 men for its operation.

The disposal of night soil, J. W. LEATHER (*Indian Agr., 21 (1896), No. 6, pp. 171, 172*).

Effect of food on the bacteria content of cow dung, WÜTHRICK and VON FREUDENREICH (*Jahr. Molkerei-Schule Rutti, 1894; abs. in Milch Ztg., 25 (1896), No. 5, p. 70*).

Variations in the composition of apatites, A. CARNOT (*Compt. Rend., 122 (1896), No. 24, pp. 1375–1380*).

On the composition of Thomas slag and the determination of its agricultural value (*Kgl. Landt. Akad. Handl. Tidskr., 35 (1896), pp. 16–55*).

Danish coöperative fertilizer experiments during 1895, K. HANSEN (*Landmandsblade, 29 (1896), pp. 81–91*).

Fertilizer experiments at European agricultural experiment stations, P. HELLSTROM (*Rpt. Ultuna Agl. Inst., 189 , Upsala (Sweden); 1894, pp. 110–172*).

On the control and sale of artificial fertilizers in European countries, P. HELLSTROM (*Rpt. Ultuna Agl. Inst., 189 , Upsala (Sweden); 1894, pp. 83–110*).

Examination of fertilizers during 1895 at Alnarp agricultural laboratory, M. WEIBULL (*Tidskr. Landtman, 17 (1896), pp. 165–169*).

FIELD CROPS.

Suggestions in reference to systematic methods of manuring, E. B. VOORHEES (*New Jersey Stas. Bul. 111, pp. 3, 4, 6–11*).—A summary is given of the results of over 150 coöperative field fertilizer experiments carried on by the station, nearly every county in the State having one or more.

Corn (pp. 3, 4).—In 9 out of 13 experiments the largest yields of corn were with superphosphate and potash used singly or in combination. The cost of the increased yields with barnyard manure made its use less profitable than commercial fertilizers.

Oats (p. 4).—In 6 experiments with oats on soils of medium fertility the application of phosphoric acid and nitrogen were very beneficial.

Wheat and rye (p. 4).—In 11 experiments phosphoric acid and nitrogen gave best results.

Potatoes (p. 4).—Decided benefits were received from both commercial fertilizers and barnyard manure. Of the different forms of potash the muriate appeared to exert the greatest influence on the yield, while with the sulphate the yield was nearly as great and the quality improved. The results with complete fertilizers were more profitable than with either minerals alone or yard manure, though nitrogen was especially useful only on soils of medium fertility.

The author gives, in conclusion, some practical suggestions in detail on how to purchase and use barnyard and commercial manures in connection with different rotations, so that the soil may produce good crops and at the same time increase in fertility.

Fertilizer experiments on corn, oats, wheat, and grass, H. J. WATERS and E. H. HESS (*Pennsylvania Sta. Rpt. 1894, pp. 258–281, dgms. 3, chart 1*).—This is a continuation of work published in the Annual Report of the Station for 1893 (E. S. R., 6, p. 720). Three 4-year rotations with wheat, clover and timothy, corn, and oats were completed in 1894, and the results are reported. Tabulated data are given for 12 years, showing the yield per acre of the different plats, the effect of different combinations and different amounts of fertilizers, and the valuation per acre with the different fertilizers of the corn (ears and stover), wheat (grain and straw), oats (grain and straw), and the grass. The results are shown graphically by charts and a diagram. To show the average results of the various fertilizers upon the 4 crops considered, the yields are calculated to their money value, the average price for each crop for the 12 years being used.

The author's conclusions may be summarized as follows: The application of phosphoric acid has in every instance, whether used singly, mixed with one other ingredient, or as a complete fertilizer, produced an increased yield; and this appeared to be the element most needed by the soil. Only a very slight increase was obtained from the use of nitrogen or potash, except when applied with phosphoric acid. Nitrogen as nitrate gave larger returns than when used in organic form or in sulphate of ammonia. Twenty four pounds of nitrogen was the most profitable amount to apply, either alone or in combination with other fertilizer ingredients. The yields from the application of barnyard manure were less than from a moderate application of a complete fertilizer. The increase in yield from the use of lime, ground limestone, or gypsum was very slight.

Fertilizer, culture, and variety experiments with corn, R. J. REDDING (*Georgia Sta. Bul. 30, pp. 357–379*).

Synopsis.—A continuation of work of previous years is summarized under the following heads: Fertilizer experiments, detasseling, residual effect of fertilizers, variety tests, methods of harvesting, analyses of different parts of the corn plant, and tests of shredding machine.

These experiments are in continuation of work published in Bulletins 23 and 27 of the station (E. S. R., 6, pp. 526, 883). The rainfall for the season is tabulated and the weather conditions noted.

Fertilizer experiments (pp. 357–366).—The basal mixture consisted of 312 lbs. of acid phosphate, 18.72 lbs. of muriate of potash, 208 lbs. cotton-seed meal, and 36.4 lbs. nitrate of soda, and cost $4.76 per acre. The largest yield cost 54.5 cts. per bushel in the first and 46.9 cts. in the second trial. The conclusions agree with those of previous years that it is not expedient to rely on commercial fertilizers for corn, but that this crop should follow a well-fertilized cotton crop.

Detasseling, (pp. 366–368).—This is in continuation of work published in Bulletin 23 of the station (E. S. R., 6, p. 526). Alternate rows were detasseled; the perfect rows yielded 0.80 bu. per acre more than the detasseled rows.

Residual effect of fertilizers (pp. 368, 369).—This was to test the effect on corn of a fertilizer applied in different amounts on the preceding crop of cotton. The results were unsatisfactory.

Variety test (pp. 369–372).—Of 15 varieties tested the highest yield, 45.55 bu. per acre, was produced by Shaw Improved and Higgins. The highest yield in an average of 4 years among 5 varieties was given by Shaw Improved (34.22 bu. per acre).

Methods of harvesting (pp. 372–374, 379).—On a plat 168 feet long, 52 rows, fertilized and cultivated alike, were harvested as follows: One-third was left standing till the ears were dry; from one-third the blades were pulled August 20, and weighed when dry; one-third was cut and shocked August 20.

The results are tabulated. The yield of shelled corn was 34.2 bu. per acre from all 3 methods of harvesting. The total value of products is given as \$26.69 from harvesting entire stalks, \$20.66 from harvesting ears and blades, and \$17.10 from ears only. No difficulty was experienced in curing the corn in shock.

Analysis and feeding value of different parts of the corn plant (pp. 374–378).—At the time of harvesting the crop, August 20, 5 average plants were selected for analysis. The following table gives the divisions of the plant, the per cent each division is of the whole plant in air-dry condition, and the food constituents and ash found in each division. The butts are that part of the stalks below the ear; the top stalks that part of the stalks between the ear and the tassel.

Analysis of parts of the corn plant.

Parts of plant.	Share of whole plant	Water.	Crude protein.	Crude fiber	Crude fat	Nitrogen free extract.	Ash.
	Per cent	*Per cent.*	*Per cent*	*Per cent*	*Per cent*	*Per cent.*	*Per cent.*
Butts	24.14	18.76	2.12	26.36	1.09	49.64	3.03
Top stalks	5.14	20.14	4.86	24.70	1.12	46.57	2.61
Blades from butts	6.18	21.15	6.14	25.38	0.90	43.28	3.15
Blades from tops	3.65	19.62	6.20	21.73	1.04	47.31	4.10
Shucks	11.13	17.20	4.27	29.45	1.00	44.86	3.22
Tassels	1.30	19.31	5.31	30.10	0.87	39.30	5.11
Grain [1]	38.77	10.80	10.20	2.20	4.90	69.80	1.50
Cobs [1]	9.69	10.70	2.40	30.10	0.50	54.90	1.40

[1] Analysis of E. H Jenkins.

Calculations are given of the total yield per acre of the different parts of the corn plant, and the total digestible matter therein, on the basis of 40 bu. of shelled corn per acre.

Shredding machine (p. 378).—A shredding machine was tried at the station with satisfactory results; the shredded fodder was readily eaten by the stock.

Corn experiments, 1895, E. DAVENPORT and W. J. FRASER (*Illinois Sta. Bul. 42, pp. 163–179*).

Synopsis.—Experiments are reported on (1) test of varieties, (2) time of planting, (3) thickness of planting, (4) continuous cropping *vs.* rotation, and (5) rate of growth. The results of these and previous experiments at the station favor (1) medium maturing varieties, (2) neither early nor late planting, (3) planting 5 kernels in a hill rather than less, and (4) rotation of crops.

The experiments in 1895 were in continuation of those reported in Bulletin 37 of the station (E. S. R., 6, p. 980), and were conducted on a

deep, rich prairie soil. The corn was planted in hills 3 ft. 8 in. apart each way. A meterological summary for the years 1889–'95, inclusive, and tabulated data for each experiment are given.

Test of varieties (pp. 163–173, 179).—This trial test of 81 varieties occupied 100 fortieth-acre plats, 80 plats having been in corn the previous year and 20 in wheat. The plats were fall-plowed and well harrowed before planting.

One variety, planted on 13 different plats scattered throughout the trial area, ranged from early to late, and in yield from 45.8 to 100.8 bu. per acre. The authors say "It will not do to credit all [the] variations in yield to varietal differences . . . so unaccountable are these extreme variations in yield that it seems necessary to resort to systematic duplication . . . to give anything like a just comparison for a single season. . . . It is therefore only after a long series of years and from plantings in a variety of plats that anything like a true comparison can be established."

Usually medium maturing varieties have given slightly the highest average yield; but in 1895 the highest average was from the late sorts.

Time of planting (pp. 173–175, 179).—Nine plantings of the same variety of corn were made one week apart between April 22 and June 17. Medium plantings gave highest yields.

Thickness of planting (pp. 175, 176, 179).—Plantings at successive dates were thinned to 4 rates of seeding, 2, 3, 4, and 5 kernels to the hill. Thicker plantings gave the higher yields with smaller ears and more nubbins; for all varieties about 11 per cent of the stalks were usually barren; but this varied greatly with both variety and season. With maximum yields there are generally about 10,000 ears per acre.

Rotation experiment (pp. 176–179).—Corn grown continuously, with and without manure, was compared with corn in rotation with oats, and with oats and clover.

The yield of corn on unmanured land decreased in rotation with corn and to a less degree in rotation with oats. Land under a rotation containing clover gives decidedly superior yields. No effect was observed from commercial fertilizers.

Rate of growth (p. 178).—This is to a considerable degree independent of the temperature and dependent upon the stage of development which the corn plant has reached.

Lucern in Argentina and England, H. GIBSON and W. FREAM (*Indian Agr., 21 (1896), No. 3, pp. 82, 83*).—In Argentina lucern, or alfalfa, is grown both for hay and pasture. In the province of Buenos Ayres nearly every "Estancia" (stock-breeding estate) has its field of 10 to 40 acres of alfalfa. The land is plowed, cross-harrowed, and

sown with 26 to 36 lbs. of seed per acre. Sowing in autumn, spring (which begins September 24), and midsummer is practiced. The crop is cut 4 or 5 times each year, and the total hay crop from it averages from 6 to 10 tons per acre. The first cutting is generally gathered by the end of November, and the last by the end of March or beginning of April. These alfalfa fields last a long time. Fields 30 years old are known, still well covered and yielding a good crop.

In the provinces of Buenos Ayres, Santa Fé, and part of Cordoba the soil is a rich, black loam of great depth. Here the alfalfa follows wheat and is pastured.

"With regard to the possible extent of land capable of carrying lucern for grazing purposes, it is difficult to establish the limit. Alfalfa has done equally well in the rich, deep soil of Santa Fé and the sandy, loose earth of the Pampas formation which begins in Cordoba.

"It is to be found thriving in the far West in Mendoza and San Luis, and experiments in the south of the province of Buenos Ayres have been attended with success. . . . I have found it to grow well in latitude 36 to 37° S. . . . The zone where, by reason of the conditions of soil and climate, alfalfa can be permanently laid down, embraces an area of not much less than 150,000 sq. miles."

Exporting alfalfa hay has become a business of considerable importance. In the province of Santa Fé the roots of alfalfa have been found at a depth of 40 ft. The greatest enemy of alfalfa is the migratory locust.

In England, in the course of 10 years, 1885–'95, the area of cultivation of alfalfa has extended from 13,754 acres to 23,853 acres. This is mainly in the eastern and south central parts of England.

Oat culture, R. J. REDDING (*Georgia Sta. Bul. 30, pp. 383–385*).—Ten acres, manured with 200 lbs. acid phosphate, 50 lbs. muriate of potash, and 400 lbs. cotton-seed meal per acre, were sown to oats in October and November. This sowing was killed by frost. During the last week in February the piece was resown to the "Burt," an early rapid growing variety of oats. Early in April the crop was fertilized with 50 lbs. of nitrate of soda per acre, except one-tenth acre in one of the best acres of the field. This tenth acre yielded at the rate of 42 bu. per acre, and the adjacent tenths of an acre yielded 60 bu., a gain of 18 bu. in favor of the nitrated portions.

The whole piece averaged 40 bu. per acre.

Some cultural directions for oats are given in which fall or winter sowing is recommended in preference to spring sowing, on land fertilized with a complete manure.

Experiments with oats, 1888–1895, E. DAVENPORT and W. J. FRASER (*Illinois Sta. Bul. 41, pp. 156–160*).—This is a continuation of work published in Bulletin No. 34 of the station (E. S. R., 6, p. 408). For the years 1888 to 1895 notes and tabulated data are given on the quantity of seed per acre between 1 and 4 bu., the time of sowing between March 14 and May 10, on the depth of sowing between 1 and 6 in., on broadcast *vs.* drill sowing, and on a test of 28 varieties.

The authors give the following summary of results:

"Within reasonable limits thickness of seeding has little influence upon yield, with a preference decided though slight in favor of 2¼ bu. per acre.

"From different thickness of seeding the yield of grain and its weight per bushel are quite independent of the weight of straw.

"The most favorable time for sowing is the very last of March, with a tendency favoring an earlier date.

"Yields of grain and straw from seedings at different dates fluctuate more nearly together than do those from different rates of seeding.

"Comparatively shallow seeding is necessary.

"Maximum yields may be had with medium weights of straw.

"The low yields of the season of 1895 are due to the remarkably dry season."

Variety tests of oats, H. J. WATERS and E. H. HESS (*Pennsylvania Sta. Rpt. 1894, pp. 290, 291*).—In 1894 16 varieties of oats were grown on duplicate twentieth-acre plats. The yields of grain and straw and the weight per struck bushel for the years 1888 to 1894 inclusive are tabulated. The highest average yields were given by Japan, Baltic White, Improved American, and German, all having produced an average of over 40 bu. per acre.

Variety tests of potatoes, H. J. WATERS and E. H. HESS (*Pennsylvania Sta. Rpt. 1894, pp. 292, 293*).—This is a continuation of work published in the Annual Report of the Station for 1893 (E. S. R., 6, p. 722). In 1894 16 varieties of potatoes were grown, in rows 42 in. apart, pieces 12 in. in the row. Clean, shallow, and level culture was practiced. The yields tabulated are for the years 1889 to 1894 inclusive.

The highest average yields were given by Stone-Road No. 2, Early Puritan, Ben Harrison, Burpee Superior, and Green Mountain.

Saltbushes, J. G. SMITH (*U. S. Dept. Agr., Div. of Agrostology Circ. 3, pp. 4, figs. 3*).—The Australian saltbushes (*Atriplex semibaccata* and *A. leptocarpa*) and "Winter fat" or sweet sage (*Eurotia lanata*) are figured and a general statement given of the practical value of saltbushes. There are over 30 different kinds of American saltbushes. In dry seasons and during severe winters they supplement the native grasses. They are natives of the arid and semiarid uplands and grow where better forage plants will not, and they should be preserved from extinction. Foreign varieties should be introduced with caution.

Fertilizer experiments on tobacco, W. FREAR (*Pennsylvania Sta. Rpt. 1894, pp. 169–189*).

Size of leaves of cured crop (pp. 174–176).—Tabulated data are given for the length and breadth of the cured leaves grown with different applications of fertilizers. The leaves grown at Rocky Spring were 10 per cent larger than those grown at Donegal.

Sweated tobacco (pp. 176–185).—Tabulated data are given for loss in sweating, weight of leaves, and proportion of rib, and for thickness of leaves.

The average loss in sweating at Donegal was 10.47 per cent, and at Rocky Spring 12.82 per cent. Tobacco grown with stable manure lost

more than any other; that grown with the carbonates of potash and magnesia lost more than that with sulphates.

The thinnest leaves grew on the unfertilized plats.

Duration of glow (pp. 185–188).—"The test was made upon the selected wrappers already examined as to thickness and density. The dried leaf was touched with a glowing cigar tip, and the time elapsing till the running spark died out was noted. The results reported are the average of 5 such tests upon the tobacco from each plat." Tabulated data are given. There was no distinctive difference between the results from tobacco grown with different commercial fertilizers.

Experiments for 1894 (pp. 188, 189).—This is a report of progress, since the results from the cured crop had not been obtained. The plan of operation was the same as in 1893, except that sulphate of ammonia was used instead of nitrate of soda as a substitute for half the cotton seed meal.

Experiments on the curing of tobacco, W. FREAR and E. J. HALEY (*Pennsylvania Sta. Rpt. 1894, pp. 189–201, 206–257*).—A general discussion of the manner of curing tobacco is given, in which the different processes used in this and foreign countries are reviewed.

Air-curing process with whole stalks and with separate leaves (pp. 208–218).—This trial was conducted in an old fashioned tobacco shed 30 by 60 ft., 15 ft. to the plate. It was ventilated by vertical shutters on 2 sides, by large doors at one end, and by the openings between the shrunken siding. The floor of this shed was carefully cleared of all scraps of tobacco and limed. August 28, when the middle leaves were mature, one fourth acre of tobacco, harvested on the stalk and slightly wilted, was hung in the shed on 4-foot laths 18 to 24 in. apart, 7 stalks to a lath. The laths were placed in 3 horizontal tiers, which were a little over a foot apart.

At the same time the ripened lower and middle leaves from another fourth-acre were broken from the stalks, brought to the shed, and strung upon the wires of the Snow lath. During the whole period daily observations of the temperature and humidity were made on the east and west sides and on the floor of the shed, and a continuous record of the temperature among the curing leaves was kept by a self-recording thermometer. The meteorological and other data are tabulated. In the shed the temperature ranged from 44 to 88° F. and the humidity from 56 to 100°, the humidity as a rule being below that outside.

"The leaf began to yellow in 60 hours after the curing was begun, beginning at the tips and borders and gradually working up toward the midrib and base of the leaf. By the time the body of the leaf had attained the yellow color, the tips and borders had begun to turn brown; this browning was accompanied by a curling and drying of the tip and edges. During this stage of the process, while the leaf was sweating, the temperature ranged from 70 to 75°, and the relative humidity increased from 70 to 88 per cent. . . . The browning of the web of the leaf progressed slowly and was not completed until the twenty-third day of the curing."

The whole process of curing required 40 days. Similar observations were also made at Lititz and Rocky Spring. Among the leaves harvested separately "the first yellowing appeared after 42 hours. The borders and tips of the leaves were yellow in 66 hours. The first trace of brown appeared after 90 hours. The web of the leaf was cured in 16 days and the rib of the leaves first introduced into the curing shed 20 days later, making the total period required for the cure 36 days."

The loss of weight was 77.55 per cent with the whole stalk and 84.51 with the leaves cured separately.

The Snow process (pp. 218–230).—The unpatented lath invented by Mr. Snow, and which gave the name to the process, consists of a stick 4 to 4½ ft. long, with a rectangular cross section and with wires projecting on opposite sides, each long enough to hold about 5 leaves, 70 leaves to the lath. The shed should be tight, with ventilators that may be opened at will, and with furnaces for heating. The harvesting of the one fourth acre set apart for this process began August 27; the ripest or bottom leaves from each stalk, not exceeding 5 or 6, were removed, placed in baskets, and carried to the barn. The laths when filled were placed 10½ in. apart. Heat was supplied artificially and regulated according to the outside temperature and the condition of the curing leaves. Tabulated data are given: "The average of 5 days' observations at 4 p.m., taken in the front, middle, and rear of the barn, lower tier, and in the second tier back, give the following temperature averages: Front, 104.2°; middle, 101.4°; back, 106.6°; second tier, 103°. The tobacco over the ovens and over the drum received, therefore, the greatest amount of heat."

The time required for first yellowing was 22 hours; for first browning, 24 hours; for development of tobacco odor, 60 hours; for complete curing of leaf tissue, 18 hours; for complete drying of rib, 34 hours; in all, 158 hours, or 6 days and 14 hours.

"The curing having been completed, the fires were allowed to go out; 20 hours afterwards the temperature was like that outside, and water was sprinkled over the basement floor. The next day the leaves were ready to handle, were taken down, sorted, and made up into hands.

"The total curing operation, including the filling of the barn and the removal and sorting of the leaf, occupied only 9 days."

Modified Snow process (pp. 230–234).—In this process the temperature was not allowed to go above 100° F., the beginning of the rise was gradual and the draft through the barn greatly increased. By accident smoke escaped into the building, and the fires were drawn for 18 hours. By this time the leaf was completely cured. This process required 42 hours to the appearance of yellow spots; to appearance of brown color, 28 hours; to development of tobacco odor, 24 hours; to end of sweating, 72 hours, and to completion of curing, 216 hours; in all, 382 hours, or 15 days and 22 hours.

Cuban process (pp. 234–237).—Two trenches, 2 ft. deep, were dug in dry ground, filled with hickory wood, and this set on fire at noon

September 3, and drawn at 3.30 p. m. The ashes and embers were removed and the trenches lined with a layer of green grass. They were then filled with Havana leaf—the ripened top leaves on the quarter acre devoted to the Snow process being used, together with some ripe seed leaf. The leaves were placed smoothly and closely. The filling was completed at 5 p. m. Over the top was placed a layer of ripe meadow grass, building paper, and 6 to 8 in. of earth. The temperature in the trench, as shown by a garden thermometer, rose to over 120° F., and between 5 p. m. September 3, and 4 p. m. September 5, ranged from 93 to 104° F. When the leaves were removed September 5, 4 p. m., they emitted an odor like decayed tomato vines, and gave off considerable ammonia. Both faces of the leaves were very wet. The sap appeared to be removed from the leaf tissue, but not from the rib. The leaf tissue was dark, translucent, and tough. The leaves were dried in an ordinary shed, when they assumed a purplish black tint. The loss in weight in drying by this process was 90.4 per cent.

Comparison of the several curing processes (pp. 237–257).—The first examination was made by experienced tobacco packers at the curing barn in October, at which time "only the product of the 2 Snow process cures and some air cured leaf from an entirely different experiment were in condition for careful examination. . . . The tobacco was found to be well cured and of excellent color," but not fine. "The leaves were thick and 'greasy,' not thin, elastic, and silky as is required in high-grade wrappers." The tobacco cured by the usual process was better than the other; but no comparison was made of any single sample from the same plat and cured by both processes.

Samples were also submitted to tobacco experts in New York; one considered the air cured sample the best, two the Snow cured, and one thought each best for particular uses.

As to curing leaf alone *vs.* curing leaf on stalk, the authors found that on the average 72.70 per cent of the whole weight of the plant was leaf; and that the cured leaf constituted 15.8 per cent of the weight of the original leaf with the stalk-cured tobacco, and 14.4 per cent with the leaf cured; likewise the leaf tissue was 11.1 per cent in the former and 10.3 per cent in the latter case.

The authors conclude that "there is little difference in the losses of substance during curing by the 2 methods."

As to air curing *vs.* artificial heat, the authors say that the final thickness of the leaf seems to be dependent upon prior conditions of growth rather than upon the methods of curing.

Tobacco cured by the "Cuban" process gave off no tobacco aroma when smoked; the taste was sharp and tarry, and the effect on all who tested it was nauseating.

Experiments on the burning quality of tobacco, A. SCERHATI (*Jour. Landw., 43 (1895), No. 4, pp. 379–458*).—The author reviews and

discusses the work of previous experimenters. A number of series of both pot and plat trials were made and tests of the burning quality of tobacco grown in these trials and elsewhere were made, aggregating in number over 3,300.

The method adopted for determining the burning quality was to cut the tobacco leaf in two, crosswise, in the middle, and note the time of burning after lighting the whole cut edge of one-half in a gas jet. By means of a chronograph the duration of the glow was exactly determined. The influence of the variety of tobacco, the climate, weather, and soil, and of the different sorts, qualities, and combinations of manures on the burning quality of tobacco are discussed in connection with the tabulated data given.

The author concludes in part as follows: Nessler's assertion that tobacco which contains more than 0.4 per cent of chlorin and at the same time less than 2.5 per cent of potash does not burn well is not proven, nor that the burning quality depends primarily on the content of chlorin or potash. The burning quality varies with the position of the leaf on the tobacco stalk, the leaves growing in the center of the stem usually burning best. The variety also has considerable influence. A moist climate and warm moist weather promote the burning quality while drought hinders it. The physical properties of the soil have primarily an important influence, a warm, moist, fertile soil producing the best burning tobacco under otherwise equal conditions. Barnyard manure applied in the spring is not as injurious to the burning quality of tobacco as many assert, and generally has little influence. With a one-sided application of nitrogen, sulphate of ammonia injures the burning quality, while nitrate of soda does not. Phosphoric acid is generally not injurious to the burning quality of tobacco, and potash manures have by no means the favorable effect that is generally believed; they are without effect in clay soils, and of greatest advantage in sandy soils. In soils poor in lime liming is especially advantageous for the burning quality of tobacco.

Experiments with wheat, E. DAVENPORT and W. J. FRASER (*Illinois Sta. Bul. 41, pp. 117–155*).—Previous work in this line was published in Bulletin No. 34 of the station (E. S. R., 6, p. 412).

A meteorological record is given for the years 1888 to 1895 and notes and tabulated data during 4 years on the comparative weights of grain cut at different stages of maturity and cured in the shade, in the sun, and with the heads separated from the straw; on wheat sown during 6 years at the rate of 3 to 9 pecks per acre; on date of sowing between September 10 and October 8–15; on coöperative tests of fertilizers in southern Illinois, and on a test of 73 varieties.

The authors give the following summary of results:

"There is a steady increase in dry matter up to the stage of full maturity, and curing in the shade has a slight advantage over drying in the sun.

"Between 5 and 8 pecks of seed an acre there is little or no difference in yield.

"Sowings from September 10 to October 1 yield about equally, with a slight tendency to favor September 20. In the best seasons the later sowings give the highest yields.

"Barnyard manure is of great benefit upon the white clay soils of southern Illinois, and in most instances notably better than superphosphate.

"The variations in yield of a single variety on separate but neighboring plats are nearly as great as between different varieties.

"Trustworthy determinations of yield are difficult to secure and can be had only after a long series of years, or from duplicate plats upon land whose previous history is known."

Experiments with wheat and oats at Grignon in 1895, P. P. DEHÉRAIN (*Ann. Agron., 21 (1895), No. 12, pp. 515-565*).—The author says in the introduction that the culture of wheat in France covers each year nearly 7,000,000 hectares (17,297,000 acres). The average production is only 16 to 17 hectolitres (18.4 to 19.55 bu. per acre). Outside of the hot southern region the returns can be increased one-third.

A meteorological summary is given for the year ending October, 1894.

Wheat, size of kernels for seed.—During several years F. Desprez has selected the largest and the smallest grains of 5 varieties and sown them separately. From the grain produced, the largest kernels from the large ones were grown, and the smallest kernels from the small ones, and so on. The tabulated results for the 3 years, 1893-'95, show a large increase from sowing the large kernels.

Wheat, test of varieties.—At Grignon the square-head varieties are sown and found to be well adapted. Two new square heads, a white and a red, and a number of other varieties were tried. The yields of plats are tabulated and discussed. Australian wheat gave the largest yield, 57.99 bu. per acre, followed by Dattell, 49.37 bu., and the square-head varieties: Porion, 46.24 bu., Scholley, 45.80 bu.; red, 43.87 bu., and white, 39.85 bu.

Manuring and place of wheat in the rotation.—Square-head Scholley sown after beets, manured, sown without manure, and without manure but with supplementary working of the soil, gave a yield of 11.04 bu. per acre more than when grown after fodder corn with 22 tons of manure per acre, or without manure with a supplementary working of the soil, or with a very moderate application of manure direct. The difference is attributed to the effect of the manure applied to the previous crop and to the place of wheat in the rotation; and preference is given to sowing wheat after beets that have been manured; after clover, with the additional application of manure, or after potatoes that have been manured.

Oats, test of varieties.—Of the 2 varieties tried, Ligowo yielded 115.7 bu. to 135.2 bu. per acre of grain and 2.54 to 2.85 tons of straw per

acre; Salines yielded 111.4 bu. of grain and 7.58 to 7.80 tons of straw per acre.

Variety tests of wheat, H. J. WATERS and E. H. HESS (*Pennsylvania Sta. Rpt. 1894, pp. 282–290*).—This is a continuation of work published in the Annual Report of the Station for 1893 (E. S. R., 6, pp. 716, 719). On duplicate thirtieth-acre plats 44 varieties of winter wheat were tested in 1894. Tabulated data are given embracing yields of grain and straw for all varieties, and weight per struck bushel of many varieties, for the years 1887 to 1894, inclusive. The highest yields for 1894 were given by Reliable, Ontario Wonder, Rudy, Canada Wonder, Fulcaster, Valley, German Emperor, Extra Early Oakley, Royal Australian, Theiss Pool, Deitz, Fultz, Nigger, Finley, Deitz Longberry Red, Egyptian, Tuscan Island, and Mediterranean, all of which yielded over 30 bu. per acre.

During the past 5 years 7 varieties have returned an average of more than 30 bu. per acre, viz: Reliable, Valley, Fulcaster, Ontario Wonder, Deitz Longberry Red, Wyandotte Red, and Currell Prolific.

Experiments with foreign wheats, R. C. KEDZIE (*Address read before the Michigan State Millers' Association, Jan. 14, 1896*).—The author discusses the questions how to raise the grades of Michigan wheats, wheat breeding, cross breeding wheats in Australia, and how to determine the milling qualities of wheat, and quotes the report of a committee of the Millers' Association on Buda Pesth winter wheat. Ten varieties of foreign wheats obtained through Mr. M. A. Carleton, of this Department, and 2 procured from Germany by Director Smith, of the Michigan Station, have been sown for trial.

The Buda Pesth winter wheat is spoken of as harder than the hard Fife of North Dakota: 20 bu. yielded 330 lbs. of patent flour, 440 lbs. clear, 8 lbs. of low grade, 36 lbs. fine middlings, 168 lbs. middlings, 177 lbs. bran, and 40 lbs. screenings. As a result of a baking test the flour was reported to be of a higher standard than spring wheat patent.

A table is given of the composition of 18 varieties of Michigan wheat and 15 of foreign wheat.

The Poona experimental farm, J. W. MOLLISON (*Indian Agr., 21 (1896) No. 1, pp. 11–15*).—Variety tests were made with Indian, American, and African sorghums, and teosinte. The largest yield was given by American sugar sorghum (*Sorghum saccharatum*), followed by Nilva Jowari (*S. vulgare*), Imphee (*S. saccharatum*), and Sundia Jowari (*S. cernuus*). The last is regarded as one of the best fodder crops for that country. The author says that teosinte yields well in a season of good rainfall, but the fodder is coarse and the stalks thick and woody.

The wild forms of cotton (*Gossypium stocksii*), (*G. arboreum*), and (*G. wightianum*) have been under cultivation for 2 years with a view to improve them and to secure better cultivated varieties by crossing or by sports from the seed of the wild forms. The results so far are of no practical value.

In a trial of plows the turn-wrist plow was thought by the author to be best suited to the conditions of Indian agriculture. By this plow the furrows are all turned in the same direction while plowing a field.

Cawnpore experimental farm, F. E. TAYLOR (*Indian Agr.*, *21 (1896), No. 3, pp. 76–79*).—This is a report on a fertilizer experiment with Indian corn, a test of different varieties of cotton, an experiment with mixed crops, a test of the vitality and productive power of indigo seeds of different ages, and a fertilizer experiment with wheat. The American varieties of cotton, Upland, Georgian, S. B. Maxey, Jones Improved, and Shine Early Prolific were grown with good results.

Some culture experiments with winter barley, J. ERIKSSON (*Kgl. Landt. Akad. Handl. Tidskr.*, *35 (1896), pp. 87–91*).

In what stage of ripeness shall barley for brewing be harvested? (*Deut. landw. Presse*, *23 (1896), No. 51, pp. 449, 450*).—The results are given, with tabulated data, of experiments carried on with 4 varieties of barley by the experiment station and school for brewing at Berlin. The barley was harvested in the milk stage, yellow ripe, fully ripe, and dead ripe. The milk ripe barley was uniformly considered unsuitable for brewing, and the yellow ripe stood far behind the fully ripe and the dead ripe. Between the latter two there was little difference, showing that the brewing value of barley increases with advancing ripeness. The varieties stood as follows in the order of yield of extract: Chevalier, Hanna, Goldthorpe, and Selchower.

Crimson clover, D. O. NOURSE (*Virginia Sta. Bul. 41, pp. 113–117*).—A popular article on crimson clover (*Trifolium incarnatum*), treating of the season for sowing, habits of growth, and value of crimson clover for silage and hay.

Cotton culture, R. J. REDDING (*Georgia Sta. Bul. 30, pp. 379–382*).—This is in part a reprint from Bulletin 27 of the station (E. S. R., 6, p. 881), followed by some general cultural directions.

The fiber bearing plants of Florida, C. W. PARSONS (*Associated Railway Land Department, Savannah, 1895, pp. 62, figs. 15, pls. 5*).—Popular descriptions are given of Florida hemp (*Agave sisalana*), bow-string hemp (*Sanseviera* spp.), wild pineapple (*Bromelia sylvestris*), pineapple (*Anana sativa*), Florida jute (*Urena lobata*), and ramie (*Boehmeria nivea*), and their adaptability to fiber manufacture.

Practical manual for the culture of fodder plants, C. and H. DENAIFFE (*Manuel pratique de culture fourragère. Paris: J. B. Baillière et fils, 1896, pp. 369, figs. 108*).—The principal topics treated of are the laying down and maintenance of meadows; harvesting, preservation, use, and food value of forage plants; grasses, legumes, and other forage plants; plants injurious to meadows; silage; and a series of tables of interest in connection with fodder plants.

The authors differ from recognized authorities in claiming that maize originated in the Levant instead of on the Western Continent.

Composition of certain forage plants—spurry, Lathyrus sylvestris, mint hay, R. C. KEDZIE (*Michigan Sta. Rpt. 1894, pp. 131–135*).—A reprint from Bulletin 101 of the station (E. S. R., 5, p. 782).

Chemical-botanical analyses of hay from Ottenby (Sweden), A. ATTERBERG (*Tidskr. Landtmän, 17 (1896), pp. 129–132*).

Manuring, especially of hops, J. SCHNEIDER (*Jahresber. Hopfenbauvereins Tišice, 1896; abs. in Chem. Ztg., 20 (1896), No. 42, Repert., p. 157*).

Millet, A. A. CROZIER (*Michigan Sta. Rpt. 1894, pp. 422–429*).—A special bulletin compiled from Bulletin No. 117 of the station (E. S. R., 6, p. 713).

Experiments with pulses, G. VALDER (*Agl. Jour. N. S. Wales, 7 (1896), No. 1, pp. 41–43*).—Notes are given on chick pea or gram (*Cicer arietinum*), horse gram (*Dolichos biflorus*), square podded pea (*Lotus tetragonalobus*), French beans, lentils, Dolichos, tares or vetches, and Wagner's flat pea (*Lathyrus sylvestris*).

Potatoes, L. R. TAFT and R. J. CORYELL (*Michigan Sta. Rpt. 1894, pp. 327–336*).—A reprint from Bulletin 108 of the station (E. S. R., 6, p. 208).

Fertilizer tests with potatoes, L. R. TAFT and R. J. CORYELL (*Michigan Sta. Rpt. 1894, pp. 344–346*). A reprint from Bulletin 108 of the station (E. S. R., 6, p. 208).

Potato culture, J. F. DUGGAR (*U. S. Dept. Agr., Farmers' Bul. 35, pp. 23, figs. 2, dgm. 1*).—This bulletin is largely devoted to considerations relating to the most profitable amount of seed to plant. Among the topics treated are soil and rotation, manuring, varieties, planting, time to cut seed potatoes, change of seed, seed end *vs.* stem end, effect of sprouting, quantity of seed per acre, size of seed pieces, and seed tubers, use of small potatoes for planting, number of eyes and weight per set, number of cuttings and stalks per hill, distance between plants, cultivation, mulching, harvesting and storing, and second-crop potatoes.

The potato in field and garden, W. J. MALDEN (*London: William A. May, 1895, pp. 217, figs. 19, pls. 17*).—The author treats at length of the subject under the following general heads: Crop, soils, planting, manuring, seed, varieties, treatment during growth, diseases of the crop, digging and storing, cost and feeding value of the crop. Planting whole tubers that will pass through a 2-inch and not pass through a 1½-inch mesh in a sieve is recommended.

The starch content of potatoes and the sugar content of beets (*Gard. Chron., ser. 3, 19 (1896), No. 497, p. 768*).

Rice culture in southwestern Louisiana, H. H. CHILDERS (*Sci. Amer., 74 (1896), No. 19, pp. 289 and 295, figs. 5*).—Directions are given for the culture of rice. Louisiana and South Carolina are the principal rice-producing States. A rice cutting machine in operation, cyclone thresher, a warehouse, and a pumping engine are figured.

Concerning the nitrogen content of sugar-beet leaves as influenced by various fertilizers, F. ALBERT (*Festsch. zum 70 Geburtstage J. Kühn, 1895, pp. 325–329; abs. in Bot. Centbl. Beihefte, 6 (1896), No. 1, pp. 77, 78*).—The author reports a number of analyses to show that the efforts to improve the beet root have but slightly affected the feeding quality, especially the nitrogenous constituents of the leaves, and that the use of different kinds of fertilizers exerts no marked influence upon the value of the crowns and leaves of sugar beets for feeding purposes.

Culture experiments with sugar beets on Gotland marsh soils, L. F. NILSON (*Tidskr. Landtmän, 17 (1896), pp. 89–96, 109–114, 147–153*).

Seedling sugar canes (*Trans. Queensland Acclimat. Soc., 1 (1896), No. 12, pp. 212 and 214*).

Agricultural chemistry of the sugar cane, T. L. PHIPSON (*Jamaica Bot. Dept. Bul., n. ser., 3 (1896), No. 8, pp. 49–61*).

Investigations concerning the chemical physiology of sugar cane, F. A. F. C. WENT (*Onderzoekingen omtrent chemische physiologie van het Suikerriet. Soerabaia: H. van Ingen, 1896, pp. 87, pls. 8; reprinted from Arch. Java Suikerindistrie, 1896, No. 11*).

Tobacco experiments, W. FREAR and E. J. HALEY (*Pennsylvania Sta. Rpt. 1894, pp. 72–88*).—Reprint of Bulletin 30 of the station (E. S. R., 7, p. 762).

Composition of the grain and straw of wheat at different periods of ripening, R. C. KEDZIE (*Michigan Sta. Rpt. 1894, pp. 122–130, dgms. 3*).—A reprint from Bulletin 101 of the station (E. R. S., 5, p. 782).

Useful Australian plants, J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 4, pp. 193–195, pls. 2*).—Notes on the spotted gum (*Eucalyptus maculata*) and Hooker's fescue grass (*Schedonorus hookerianus*).

Economic History of Virginia in the Seventeenth Century, P. A. BRUCE (*New York: Macmillan & Co., 1896. Vol. I, pp. 634, map 1; Vol. II, pp. 647*).—The author divides the history of the Virginia people in the 17th century into 7 parts: (1) Economic conditions, (2) social life, (3) religious establishment and moral influences, (4) education, (5) military regulations, (6) administration of justice, and (7) political system.

The present work is devoted exclusively to the first head.

In its preparation the author has had "access to a great mass of original manuscripts which have never been used for the same general purpose before," including county records, State papers, British public records, etc., and the statements made are accompanied by copious footnotes and references to original documents.

Chapters 4-7, pp. 189-486, treating of agricultural development from the foundation of the colony (1607) to 1700, are of especial interest in this connection.

The rapid growth of the tobacco industry in the colony despite legislative restrictions and the sharp competition of the finer Spanish product in the European markets is strikingly brought out. The inferiority of the Virginia product was due not only to the less favorable character of the soil and climate, but also to the crude methods of culture and curing. These methods were very slowly improved. Nevertheless, tobacco became the staple product of the colony, and in fact largely served the purposes of currency. The culture of cereals was almost entirely neglected for that of tobacco, with the result in the early history of the settlement that famines were frequent or the colonists had to depend upon supplies from the Indians. Frequent attempts were made to correct this by legislation, but as a rule with little result. However, as the country became more thickly settled and the land somewhat exhausted by the culture of tobacco, cereals and other crops were cultivated more extensively. Efforts to produce cotton were made the year of the founding of Jamestown, but there is no indication that this crop was produced to any great extent in the 17th century. Attempts to grow wine grapes, though assiduously made, were not attended with any great success. With the coöperation and approval of James I, silk culture was introduced in the colony and for a time seems to have been highly successful. Flax and hemp were successfully grown, but the colonists seem to have been averse to its culture and so it was gradually abandoned. The live stock brought over by the colonists multiplied rapidly, but being allowed to range at will they soon became wild and degenerated.

As usual in a new country the most exhaustive systems of culture were generally followed and almost no use was made of the natural manures. Although a few planters used the abundant supplies of marl which were at hand its general use in this region was delayed until the next century.

HORTICULTURE.

Soil depletion in respect to the care of fruit trees, I. P. ROBERTS (*New York Cornell Sta. Bul. 103, pp. 533-549, pls. 2*).—This bulletin tabulates the results of experiments undertaken to determine, as far as possible, the amount of fertilizing ingredients taken from the soil by young and old apple trees and their fruit.

In October the leaves were picked from a 13-year-old Wagner apple tree, 18 or 20 ft. high, and analyzed. The total weight was 33.18 lbs., consisting of water 15.92 lbs., and dry matter 17.26 lbs., or 52.02 per cent of the total weight. The dry matter was found to contain nitrogen 1.85 per cent, phosphoric acid 0.48 per cent, and potash 1.76 per cent, or nitrogen 0.29 lb., phosphoric acid 0.08 lb., and potash 0.28 lb. The year after this analysis of the leaves the tree bore 5 bu. of apples. The average composition of the apples is given as water 85.3 per cent, nitrogen 0.13 per cent, phosphoric acid 0.01 per cent, and potash 0.19 per cent. Assuming that for 5 years there would be borne 5 bu. of apples annually, that in the next 5 years 10 bu. annually, and for the succeeding 10 years 15 bu., the following table shows the estimated

amount of nitrogen, phosphoric acid, and potash that would be taken from the soil in 20 years by an acre of apple trees set 35 ft. apart, or a total of 35 trees:

Fertilizing materials taken from the soil in 20 years by an acre of apple trees.

	Apples.	Leaves.	Value.
	Pounds.	*Pounds.*	
Nitrogen	498.60	456.75	$143.30
Phosphoric acid	38.25	126.00	11.50
Potash	728.55	441.00	52.63
Total value			207.43

The value of the fertilizing ingredients is computed at nitrogen 15 cts., phosphoric acid 7 cts., and potash 4.5 cts. per pound.

The amount of fertilizing ingredients removed from the soil by wheat is compared with the amount removed by apple trees, showing that in 20 years an acre of apple trees will remove $87 worth more of fertilizing materials than will an acre of wheat.

An old tree of the variety Seek-no-further, practically past bearing, was weighed and analyzed. The composition was as follows:

Composition of leaves, twigs, limbs, trunk, and roots of an old apple tree.

	Total weight.	Water.	Dry matter.	Nitrogen.	Phosphoric acid.	Potash.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Leaves	232.02	139.51	92.51	0.96	0.37	1.32
Twigs (1894 growth)	266.70	130.70	136.00	1.15	.35	.80
Twigs (1895 growth)	171.70	88.08	83.62	.86	.31	.67
Limbs and trunk	3,972.50	1,656.53	2,315.97	5.16	1.99	5.16
Roots	840.50	424.87	415.63	.92	.42	.92

The value of the fertilizing ingredients per tree and per acre of 35 trees is shown below:

Fertilizing ingredients of apple trees.

	Value.	
	Per tree.	Per acre.
Nitrogen	$1.36	$47.60
Phosphoric acid	.24	8.40
Potash	.40	14.00
Total	2.00	70.00

Based on these figures, the importance of supplying sufficient and suitable fertilizers to restore the fertilizing materials taken by the trees is insisted upon, and the value of constant manuring of orchards is urged.

A thrifty young tree of each of 6 varieties of apples, pears, peaches, and plums was analyzed, the tops and roots being analyzed separately.

The following table shows the amount and value of fertilizing constituents removed from the soil by an acre of 3-year-old nursery trees:

Fertilizing constituents removed by an acre of 3-year-old trees.

	Apples.		Pears.		Peaches.		Plums.	
	Pounds.	Value	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Nitrogen	29.07	$4.36	24.83	$3 73	22.42	$3 36	19.75	$2.96
Phosphoric acid	10.13	.71	7 83	.54	5 42	.38	4.42	.31
Potash	19.73	.89	13 33	60	11.75	.53	11.50	.52
Total	58.93	5.96	45.99	4.87	39.59	4.27	35.67	3.79

The result shows that nursery stock removes from the soil but a small amount of fertilizing materials as compared with that taken by other crops, such as corn. The usual failure to raise nursery stock with success continuously on the same land is believed to be due to the fact that the readily available fertilizing materials have been exhausted by the rapid growth of the stock, and to the fact that the ground is not always cultivated when it is in the best condition.

Letters from nurserymen are appended, giving directions for the proper culture of nursery stock.

Suggestions in reference to systematic methods of manuring, E. B. VOORHEES (*New Jersey Stas. Bul. 111, pp. 1-6*).—This bulletin contains a summary of coöperative experiments carried out by the station in nearly every county in the State.

Sweet potatoes (pp. 4, 5).—The belief is stated that satisfactory crops can be raised with commercial fertilizers alone. The net profits were greater from fertilizers than from barnyard manure alone, and a combination of the two was more satisfactory than the use of barnyard manure alone. The addition of nitrogen to superphosphate and potash was not profitable.

Tomatoes (p. 5).—The net profit from nitrate of soda was greater than that from either barnyard manure or mineral fertilizers alone. Nitrate of soda alone was but slightly less effective than complete fertilizers.

Peaches (pp. 5, 6).—As a result of 11 years' experiments the author concludes that manuring orchards was profitable and extended the profitable bearing period of the trees; that complete fertilizers were more useful than single fertilizer elements or combinations of two elements, and that commercial fertilizers were more profitable than barnyard manure.

Strawberries (p. 6).—In 3 experiments on soils well supplied with potash and phosphoric acid a spring top-dressing of nitrate of soda was followed by a profitable yield.

Small fruits in 1894, G. C. BUTZ (*Pennsylvania Sta. Bul. 32, pp. 13*).—This consists of descriptive notes and tabulated data on 33 varieties of strawberries, 22 of raspberries, and 5 of blackberries. The different varieties of strawberries were compared as regards the yield of 30 ft. of matted row, Shuster leading with a crop of over 14,000

gm., followed by Greenville, Henderson, Crawford, Warfield, and Van Deman. The lightest yield was produced by Stevens, which gave but 870 gm. A table is given showing the weight of the largest berries of each variety and the number of berries in a quart, classified by 5 different arbitrary sizes, the varieties Brandywine, Eureka, and Greenville averaging the largest berries. A quart of each of these varieties contained 55, 55, and 60 berries, respectively.

The yields from 12 plants of each of the varieties of raspberries were compared, Mammoth Cluster leading with a yield of over 17,000 gm., followed by Shaffer Colossal, Older, Ohio, Golden Queen, and Brinkle Orange. A severe frost in May, 1895, was so generally destructive to small fruits that the yield that season was reduced to a very small fraction of its average size.

Horticultural possibilities of Northwest Wisconsin, E. S. GOFF (*Wisconsin Sta. Bul. 43, pp. 27–38, figs. 5*).—This gives a general account of the status of the culture of vegetables, small fruits, and ornamentals in northwest Wisconsin. The efforts in this direction have been only recently begun. Notes are given on several truck gardens, nearly all vegetables seeming to thrive well in spite of the fact that the soil has only been under cultivation for a very few years, and the thin surface of vegetable mold has not yet been well mixed with the underlying clay. But little is being done as yet with small fruits, although it is believed that the climate and soil will prove advantageous, inasmuch as strawberries, raspberries, blackberries, currants, and gooseberries abound in a wild state, strawberries and red raspberries being especially abundant. Practically nothing has been done with orchard fruits, a few apple, plum, and cherry trees alone having been set out. A dearth of ornamental planting is to be noticed in the towns and country places in this part of the State, but where ornamentals have been set out they appear to grow well. Suggestions and recommendations are made for the planting and cultivation of vegetables and fruits, and particularly for the planting of street shade trees, advising the setting out of a limited number of trees that attain a medium size, so planted as to hide unattractive objects, develop the landscape, and exhibit dwellings to best advantage.

Contribution to the chemical composition of the pepper fruit, F. BAUER and A. HILGER (*Forschungsber. Lebensmittel Hyg. forens. Chem. Pharmakogn., 1896, p. 113; abs. in Chem. Ztg., 20 (1896), No. 12, Repert., p. 156*).—Determinations of piperin (5.55 to 7.77 per cent), furfurol-hydrazon (0.11 to 0.56 gm. per 5 gms. of pepper), and ash constituents are reported for "langen pepper," and in some cases for white and black pepper. From 6.02 to 6.80 per cent of pure ash was found, which contained P_2O_5 8.36 per cent, SO_3 3.02 per cent, HCl 9.33, Fe_2O_3 2.19, CaO 13.97, MgO 4.06, alkalies (KCl+NaCl) 62.05.

Water cress (*Amer. Hort., 6 (1896), No. 5–6, p. 72*).—Note on culture.

Variety tests of vegetables, L. R. TAFT (*Michigan Sta. Rpt. 1894, pp. 347–363*).—A reprint of Bulletin 109 of the station (E. S. R., 6, p. 218).

Peach culture in open air in Europe, A. DE BOSREDON (*Prog. Agr. et Vit., 25 (1896), Nos. 18, pp. 488–492; 19, pp. 521–527; 20, pp. 543–550*).

Peach and plum culture in Michigan, L. R. TAFT (*Michigan Sta. Rpt. 1894, pp. 170–227, figs. 9*).—A reprint of Bulletin 103 of the station (E. S. R., 6, p. 54).

Pineapple growing in Florida, P. H. ROLFS (*Garden and Forest, 9 (1896), No. 437, pp. 274–276, fig. 1*).

The blackberry (*Amer. Hort., 6 (1896), No. 5–6, pp. 65, 66*).—Cultural notes on this fruit chiefly taken from a bulletin of the New York Cornell Experiment Station.

Strawberries and raspberries, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Rpt. 1894, pp. 288–300*).—A reprint of Bulletin 106 of the station (E. S. R., 6, p. 53).

Notes on strawberry culture, E. O. ORPET (*Garden and Forest, 9 (1896), No. 437, p. 277*).

Culture of grapes under glass, P. MOUILLEFERT (*Prog. Agr. et Vit., 25 (1896), No. 24, pp. 647–654, figs. 4*).

The conditions of wine production and the fertilizer requirements of the vine in the vineyards of the Gironde, A. MÜNTZ and E. ROUSSEAUX (*Bul. Min. Agr. France, 50 (1896), Nos. 1, p. 49; 2, pp. 217–251.*)

A year among fruits, T. T. LYON (*Michigan Sta. Rpt. 1894, pp. 228–270*).—A reprint of Bulletin 104 of the station (E. S. R., 6, p. 55).

Michigan fruit list, L. R. TAFT (*Michigan Sta. Rpt. 1894, pp. 271–287*.—A reprint of Bulletin 105 of the station (E. S. R., 6, p. 52).

A contribution to the life history of pansies, V. B. WITTROCK (*Gard. Chron., ser. 3, 19 (1896), No. 495, pp. 754, 755*).

Horticulture in Norrland (Norway), L. P. NIELSSEN (*Norsk. Havetid., 12 (1896), pp. 12, 13*).

FORESTRY.

The white pine, G. PINCHOT and H. S. GRAVES (*New York: The Century Co., 1896, pp. 102, pls. 6, figs. 6*).—The authors have presented a very admirable study of the growth of the white pine, one of our most valuable timber trees. The motive which inspired the work was "the desire to assist in making clear the real nature of forestry and in facilitating and hastening the general introduction of right methods of forest management." By means of tables and diagrams a mass of information is given which will enable one to ascertain the product per tree and per acre of standing pine and to predict its increase, rendering of easy calculation the relation between growth and expenses.

The deductions of the authors are based upon observations and measurements taken of first and second growth trees in the forests of Pennsylvania and northern New York at elevations ranging from a few hundred to about 2,000 ft. While the number of localities and measurements are somewhat limited, yet they are considered sufficient for the purpose at hand, and it is believed that the estimates will be found accurate for any region where white pine abounds.

Bamboos in English gardens, W. WATSON (*Garden and Forest, 9 (1896), No. 430, pp. 206, 207*).—Notes are given upon the successful cultivation of several species of bamboos in England during the past 6 or 8 years.

The beech, its history and culture, A. WESMAEL (*Bul. Soc. Centl. Forst. Belgique, 3 (1896), Nos. 3, pp. 162–171; 5, pp. 307–323; 6, pp. 388–400*).

Durability of yellow-box timber (Eucalyptus meliodora), J. H. MAIDEN (*Agl. Gaz. N. S. Wales, 7 (1896), No. 3, p. 131*).

The culture of caoutchouc in the Antilles, G. SAUSSINO (*Jour. Agr. Prat., 60 (1896), I, No. 21, pp. 754–757*).

Contributions to the knowledge of North American conifers (continued), E. S. BASTIN and H. TRIMBLE (*Amer. Jour. Pharm., 68 (1896), No. 6, pp. 321–337, figs. 10*).—Notes are given on the general character, microscopical structure, range, chemical composition, and economics of *Pinus resinosa, P. glabra, P. montana, P. virginiana*, and *P. sylvestris*.

On the culture of some conifers in the Ardennes (*Bul. Soc. Centl. Forst. Belgique, 3 (1896), No. 4, pp. 246–249*).

Forms of some European conifers, I, H. CHRIST (*Garden and Forest, 9 (1896), No. 435, p. 252*).—Notes are given of some well-known forms of the spruce, *Picea excelsa*.

Forms of some European conifers, II, H. CHRIST (*Garden and Forest, 9 (1896), No. 437, pp. 273, 274*).

A general view of the genus Cupressus, M. T. MASTERS (*Jour. Linn. Soc. Bot., 31 (1896), No. 216, pp. 312–363, figs. 20*).—A revision of the genus, with descriptions of new species and varieties, is given.

Technical investigations of Eucalyptus timber, J. MARCHET (*Oesterr. Forst. und Jagd. Ztg., 14 (1896), No. 16, p. 121*).

Suggestions for the planting of fir trees, H. ALGAN (*Rev. Eaux et Forêts, 35 (1896), No. 7, pp. 162, 163*).

The red wood of the fir, A. CIESLAR (*Centbl. gesammte Forstwesen Wien, 22 (1896), No. 4, pp. 149–165, figs. 2*).

The red wood of firs, R. HARTIG (*Forstl. naturw. Ztschr., 5 (1896), No. 3, pp. 96–109, figs. 2*).

Report on spotted gum, with special reference to its value for wood paving, J. H. MAIDEN, G. S. COWDERY, and J. V. DECOQUE (*Agl. Gaz. N. S. Wales, 7 (1896), No. 4, pp. 196–202*).

The American linden, J. T. ROTHROCK (*Forest Leaves, 5 (1896), No. 9, p. 136, pls. 2*).—Notes are given on *Tilia americana*.

The locust tree, J. GIFFORD (*Forester, 2 (1896), No. 3, pp. 37–39*).—Notes on the locust tree (*Robinia pseudacacia*).

The sugar maples of central Michigan, W. J. BEAL (*Michigan Bd. Agr. Rpt. 1894, pp. 460–465, pls. 3*).—Notes are given of the sugar maples found in the region indicated.

On the care of oaks, H. FISCHBACH (*Allg. Forst. und Jagd. Ztg., 27 (1896), pp. 145–150*).

The red oak in France, HENRY (*Rev. Eaux et Forêts, 35 (1896), No. 7, pp. 145–155*).

The swamp white oak, J. T. ROTHROCK (*Forest Leaves, 5 (1896), No. 7, pp. 101, 105, pls. 3*).—Notes are given on *Quercus bicolor*, a tree often mistaken for *Q. alba*, the true white oak, the physical properties of the two being nearly alike, the swamp white oak being a little the stronger and heavier.

Product of white pine per acre, B. E. FERNOW (*Garden and Forest, 9 (1896) No. 430, pp. 202–206*).

Lord Weymouth's pine and its qualities, J. HOUBA (*Bul. Soc. Centl. Forst. Belgique, 3 (1896), No. 4, pp. 250–254*).—Notes are given upon *Pinus strobus*.

On the transmission of peculiarities of growth in Pinus sylvestris, M. VON SIVERS (*Forstl. naturw. Ztschr., 5 (1896), No. 5, pp. 194–197*).

Pinus muricata, C. PURDY (*Garden and Forest, 9 (1896), No. 431, p. 212*).

Comparative study of the growth of pine in calcareous and siliceous soils, D. MOROSOV (*Étude comparée des conditions de végétation du pin dans les sols calcaires, et dans les sols siliceux. Nancy: Berger-Levrault et Cie, pp 14*).

Investigations on the amount of growth in Pinus strobus, SCHWAPPACH (*Ztschr. Forst. und Jagdw., 28 (1896), No. 4, pp. 215–219*).

On the renovation of pine forests in Saxony, B. BORGGREVE (*Ztschr. Forst. und Jagdw., 28 (1896), No. 4, pp. 229–231*).

On the renovation of pines growing in shade, HOFFMANN (*Ztschr. Forst. und Jagdw., 28 (1896), No. 2, pp. 112–117*).

The increase of redwood forests, C. PURDY (*Garden and Forest, 9 (1896), No. 433, p. 238*).

Sequoia gigantea, C. A. PURPUS (*Forstl. naturw. Ztschr., 5 (1896), No. 5, pp. 198–201*).

Contributions to the life history of Sequoia sempervirens, W. R. SHAW (*Bot. Gaz., 21 (1896), No. 6, pp. 332–339, pl. 1*).

Yew trees (*Garden and Forest, 9 (1896), No. 436, pp. 261, 262*).—Notes are given of the yew trees of this and other countries. The author seems to doubt the poisonous qualities attributed to the yew in England.

Experiments on the preservation of acorns, A. CIESLAR (*Centbl. gesammte Forstwesen Wien, 22 (1896), No. 4, pp. 181-188*).

Tree planting in Glencairn, Cathcart, T. R. SIM (*Agl. Jour. Cape Colony, 9 (1896), No. 8, pp. 194-198*).

Investigations in tree growth, STOETZER (*Allg. Forst. und Jagd. Ztg., 27 (1896), pp. 109-115*).

Light and shade and their effect upon tree growth (*Bul. Soc. Centl. Forst. Belgique, 3 (1896), No. 1, pp. 225-242*).

The tannin in wood, E. HENRY (*Bul. Soc. Bot. France, 43 (1896), No. 3, pp. 124-128*).—The author divides tannin-bearing trees into 2 groups based upon whether the tannin is in the more superficial portions of the wood or distributed throughout it.

Characteristic branching of British forest trees, W. H. PURCHAS (*Science Gossip, 3 (1896), No. 25, pp. 14-16, figs. 3*).

Relation of climate to tree growth, A. C. FORBES (*Gard. Chron., ser. 3, 19 (1896), No. 494, pp. 730, 731*).

The reproductive powers of our forests, L. C. CORBETT (*Garden and Forest, 9 (1896), No. 433, p. 231, pl. 1*).—Notes are given upon the second growth of chestnut and other trees.

A method for artificially feeding trees, C. ROTH (*Chem. Ztg., 20 (1896), No. 35, pp. 341, 345, figs. 2*).

On the extension of the rotation in cutting timber, L. BERGER (*Bul. Soc. Centl. Forst. Belgique, 3 (1896), No. 4, pp. 251-258*).

Tree names, II, F. W. PRICE (*Forester, 2 (1896), No. 3, pp. 40-43*).—The scientific names, their derivation, etymology, pronunciation, and meaning are given for several orders of trees.

Some lessons from the forests of India (*Garden and Forest, 9 (1896), No. 429, pp. 191, 192*).—Notes are given of the extension of forest management in India and some of the apparent results secured.

Notes on forest culture and propagation in Algeria (*Rev. Eaux et Forêts, 35 (1896), No. 7, pp. 155-159*).

DISEASES OF PLANTS.

Injurious fungi and insects (*Jour. [British] Board Agr., 1896, No. 4, pp. 431-441, figs. 5*).—Notes are given on the turnip mildew (*Oïdium balsamii*), a potato disease (*Rhizoctonia violacea*), washes for fruit trees, and fire blast of hops.

The turnip mildew is reported as having been especially prevalent during the summer of 1895, and several other plants are mentioned which are liable to attacks of *Oïdium balsamii*. The description and life history of the fungus are given and methods for its prevention suggested. Rapidly growing plants are not as subject to attack as stunted or drought-stricken ones. Charlock and other weeds on which the fungus grows should be eradicated, and turnips sprayed with a rather strong Bordeaux mixture. Cucumbers and vegetable marrows, which are also subject to attack, may be sprayed with Bordeaux mixture, 10 lbs. of copper sulphate to 100 gals. of water, care being taken to keep the fungicide from the flowers and fruit. In houses or frames powdered sulphur may also be used.

Illustrated notes are given of the potato disease caused by *Rhizoctonia violaceæ.* This disease made its appearance in stored potatoes in Surrey and Kent. The decay begins at the end of the tuber, extending downward. At first it may be seen by cutting the tuber, when, if present, a dark line is seen extending around the potato just under the skin. The disease can spread in stored potatoes, and whenever it appears all infected tubers should be sorted out and destroyed. Care should be taken that no diseased tubers be planted. So far the disease seems to be confined to supertuberated potatoes.

Various washes are described for application to fruit trees in order to prevent insect attacks, the principal ones being arsenite solutions, kerosene emulsions, and caustic soda or potash solutions.

Several diseases of hops are grouped together under the name "fire blast." The leaves of the plant become bronzed in color, and later dark brown spotted, after which they fall. The results are somewhat like those following attacks of the red spider, but none were found on the plants. At least one form of the disease is attributed to *Heterosporium minutulum*, but in many cases neither insect nor fungus pest was present in the more aggravated cases. This latter form is considered as of widest extent, and its cause is thought to have some connection with the soil. Applications of sulphur, cultivation, or manuring had no effect upon the disease. Heavy showers in August seemed to arrest it.

Some bacteria of the potato, E. ROZE (*Compt. Rend.*, *122* (*1896*), *No. 9*, *pp. 513–515*).—The author calls attention to the potato scab fungus, *Oöspora scabies*, and describes 2 new species of Micrococcus which are said to cause definite diseases of the potato. The first of these, to which the name *Micrococcus nuclei* is given, is said to attack the potato, forming small, corky pits of about 0.5 cm. in diameter. These are first pale brown, becoming darker in time. It was found that the nuclei of the brown cells were changed in their appearance, while those in the apparently healthy adjacent cells were unchanged. On this account the specific name was given the organism. The Micrococcus is colorless, oval elliptical, $\frac{1}{2}$ by $\frac{1}{3}$ μ in size.

The second organism was found in Richter Imperator potato, where it forms in the parenchyma irregular spots 1 to 2 cm. in diameter, grayish in color, with a darker outline. If placed under a bell jar, the spots exude drops of a whitish color which by coalescence cover the surface. These are seen to be swarming with bacteria to which the name *Micrococcus imperatoris* has been given. The organism is colorless, oval elliptical, 2 by 1 μ in size. When more advanced, the grayish spots within the potato are resorbed, leaving cavities. Inoculations have been successfully made from cultures, the greatest success following inoculations made upon tubers which were afterwards buried in moist earth. So far this disease has not been observed upon any other variety than the one for which it is named.

Concerning the cause of the yellowing of the leaves of young fruit trees, J. HANAMANN (*Jour. Landw., 43 (1895), No. 4, pp. 369-378*).—The author describes a yellowing of the foliage of young fruit trees in nurseries and gardens. It must be distinguished from the yellowing that follows a long period of drought, and its cause is attributed to impaired nutrition. Analysis of leaves from sound and diseased trees show that those from the diseased trees had a higher water content and a lower amount of organic substance than the others. The ash content of the "yellowed" leaves was higher in proportion to the organic dry substance than in the sound ones. Analyses of the pure ash of the yellow leaves showed an increase of the various substances entering into its composition, with the exception of lime, and of this there was a marked reduction, although analyses of the soil showed it to be calcareous in its composition.

The smut of Japanese cereals, S. HORI (*Bot. Mag. Tokyo, 1896, pp. 76, 115*).

Comparative investigations on the agriculturally important smuts, P. HERZBERG (*Leipzig: 1895; abs. in Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 99-101*).

Combating smut by means of the hot-water method, A. SEMPOLOWSKI (*Deut. landw. Presse, 23 (1896), No. 51, pp. 454, 455*).

The grain rusts, their history and nature, J. ERIKSSON and E. HENNING (*Stockholm: 1896, p. 463. German edition: Die Getreideroste, ihre Geschichte und Natur sowie Massregeln gegen dieselben*).

Leaf blight of the potato, L. R. TAFT and R. J. CORYELL (*Michigan Sta. Rpt. 1894, p. 346*).—A reprint from Bulletin 108 of the station (E. S. R., 6, p. 228).

Potato scab, L. R. TAFT and R. J. CORYELL (*Michigan Sta. Rpt. 1894, pp. 336-343, figs. 3*).—A reprint from Bulletin 108 of the station (E. S. R., 6, p. 227).

On the potato scab, FRANK and KRÜGER (*Reprinted from Ztschr. für Spiritus Ind. in Deut. Landw. Presse, 23 (1896), No. 47, pp. 413-415, figs. 8*).

The fungus diseases of potatoes, C. WEHMER (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 9, pp. 295-300*).—Notes are given of bacterial diseases, dry rot, and attacks of Botrytis, Entorrhiza, and Rhizoctinia, together with a bibliography of 73 numbers.

Diseases of curing tobacco, W. FREAR and E. J. HALEY (*Pennsylvania Sta. Rpt. 1894, pp. 201-206*).—This article is almost wholly reprinted from Connecticut State Station Report for 1891, pp. 168-186 (E. S. R., 3, p. 773).

A disease of chicory produced by Phoma albicans, E. PRILLIEUX (*Bul. Soc. Mycol. France, 1896, p. 82*).

Notes on Cladosporium and Sporidesmium on cucumbers and gourds, R. ADERHOLD (*Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 72-76*).

A new anthracnose of the almond, M. BRIZI (*Riv. pat. Veg., 4 (1896), No. 7-12, pp. 293-303, pl. 1*).—A preliminary report on this disease has already appeared in *Ztschr. Pflanzenkrank.*

A new grape disease, COSTE-FLORET (*Prog. Agr. et Vit., 25 (1896), No. 25, pp. 683-687*).—A new disease of grapes is described under the name "Le court noué." Its cause is attributed to a faulty use of fertilizers.

The winter forms of black rot, A. PRUNET (*Compt. Rend., 122 (1896), No. 12, pp. 739-742*).

The ripening of grape wood and the effect of copper on it (*Deut. landw. Presse, 23 (1896), No. 51, p. 457*).

Should grapevines be sulphured during flowering? L. DEGRULLY (*Prog. Agr. et Vit., 25 (1896), No. 25, pp. 673, 674*).—The author thinks no harm will follow applications of sulphur at this time.

On the use of sulphate of iron on grapevines, RASSIGUIER (*Prog. Agr. et Vit., 25 (1896), No. 23, pp. 627, 628*).—The author thinks the use of solutions of sulphate of iron

late in autumn very advantageous for preventing anthracnose, and that much of the injury attributed to its use is incorrectly referred to this cause.

Grape disease in Hungary, G. LINHART and G. MEZEY (*Herausg. kgl. Ungar. Ackerbauminister, 1895: abs. in Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 91–95*).—Notes are given on the downy mildew, powdery mildew, *Sphaceloma ampelium*, *Dematophora necatrix*, *Fibrillaria xylothrica*, *Roesleria hypogæa*, *Agaricus melleus*, white rot, black rot, and the bacterial gummosis of Prillieux and Delacroix. Of these diseases all but those caused by the agaric have been found in Hungary. Experiments with a 2 per cent solution of Bordeaux mixture for the prevention of the black rot were not attended with very successful results.

The larch disease, C. Y. MICHIE (*Gard. Chron., ser. 3, 19 (1896), No. 492, pp. 670, 671*).—A summary is given of previous articles relating to this disease.

Some destructive diseases of Pseudotsuga douglasii, B. BOHM (*Ztschr. Forst. und Jagdw., 28 (1896), No. 3, pp. 154–161, figs. 5*).

Some infectious diseases of trees (*Bul. Soc. Cent. Forst. Belgique, 3 (1896), No. 5, pp. 328–354, figs. 22*).

Greenhouse plants burned by the sun, W. E. BRITTON (*Garden and Forest, 9 (1896), No. 438, p. 286*).

On the oak-leaved form of Carpinus leaves and their relation to hexenbesens, C. WEHMER (*Bot. Ztg., 54 (1896), No. 5, pp. 81–96, pl. 1*).

The more important fungus diseases of culture plants in the German colonies, P. HENNINGS (*Deut. Kolonialztg., 1895, No. 22: abs. in Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 95, 96*).—Notes are given on some diseases of coffee, vanilla, sorghum, maize, rice, cassava, sugar cane, and cotton.

Parasitic fungi and injurious insects, R. TOLF (*Svenska Mossk. For. Tidskr., 1895, pp. 327–344*).

Experiments in the treatment of chlorosis, J. M. GUILLON (*Prog. Agr. et Vit., 25 (1896), No. 4, pp. 651–666*).—A second year's report is made of experiments for controlling chlorosis, and of the various means tried iron sulphate gave the best results.

Bordeaux mixture and its application for plant diseases, W. M. SCHÖYEN (*Norsk. Landmansblade, 15 (1896), pp. 217–220*).

On the use of slightly acid Bordeaux mixture, H. DE LA VERGNE (*Prog. Agr. et Vit., 25 (1896), No. 23, pp. 638–640*).—A slightly acid solution is recommended on account of its economy, greater efficiency, and lack of carbonate of lime as a precipitate.

On the use of simple and very acid solutions of sulphate of copper, GIRET (*Prog. Agr. et Vit., 25 (1896), No. 25, pp. 679–681*).

Treatment of some fungus diseases, L. M. UNDERWOOD and F. S. EARLE (*Alabama College Sta. Bul. 69, pp. 245–272*).—The authors have given a compilation of information relating to fungus diseases and the means for their prevention. Formulas are given for preparation of several fungicides, and the more important diseases of cultivated plants are described, and preventive treatment suggested where any is known. A preliminary statement is given of the nature of fungi and their relations to other plants.

Spray calendar, E. G. LODEMAN (*Missouri Sta. Bul. 30, p. 1*).—This is a reprint of New York Cornell Station spray calendar (E. S. R., 6, p. 916).

ENTOMOLOGY.

A year with bees, R. L. TAYLOR (*Michigan Sta. Rpt. 1894, pp. 396–421*).—This recounts results of investigations with bees in 1894. The relative value of comb, foundation, and starters, when used in the brood chamber for swarms, was tested, each being used in 4 hives. The

test continued 3 weeks, the weight of the hives, bees, and honey being taken at the beginning and at the end of the experiment, and the gross weight being also taken at 2 intermediate times. The results are tabulated, and it is shown that the use of foundation gives a decided advantage in point of surplus comb honey, drawn comb standing second, and starters third. In strong colonies the honey surplus was much greater than in light ones, though the light colonies did better on starters than on either comb or foundation. The relative rate of gain was found to be better in light colonies than in strong ones, although the total gain was not so much.

At the end of the white clover honey season a number of unfinished sections were on hand, and for 4 weeks the experiment was tried of feeding extracted honey to the bees in the hope of securing a completion of the sections. Seven hives were employed in the experiment, accurate accounts being kept of the amount of honey fed, and the weight being taken before and after the experiment. The result was favorable, sufficient sections being completed to afford in value a balance of over $50 profit Out of 100 lbs. of extracted honey fed, 58 lbs. on the average appeared in the shape of comb honey. One colony converted nearly 68 per cent of the extracted honey into comb honey.

The Langdon non-swarming attachment to hives was employed on 3 styles of hives, to test its value, but with unsatisfactory results, the surplus honey produced being only from 65 to 75 per cent as much as in the ordinary way. The tendency to swarm was subdued after several ineffectual efforts had been made to leave the hive, but the queens were frequently lost in the attempt and the colonies retarded.

An automatic hiver was employed to see if it possessed its recommended value in doing away with the necessity for watchfulness of the apiarist in the hiving of swarms and the prevention of their escape. The results were unsatisfactory, as the honey produced was of small amount and the hivers were found not to restrain the tendency to swarm after it had once been established until all the queens had been destroyed or otherwise disposed of.

Brief notes are given on smokers, bee escapes, brace and burr combs, and cleansing wax with acids. A small smoker is preferred, and bee escapes are considered of value for clearing supers of bees if properly used. Setting frames with heavy top bars was found to prevent the formation of burr comb. For cleansing the wax a tablespoonful of sulphuric acid to 12 lbs. of boiling dark wax was used, with the effect of very much improving its appearance.

Remarks are made upon foul brood, its character, means of infection, symptoms, diagnosis, and cure. Removing the bees to a new hive and disinfecting the old hive by means of thoroughly boiling it and its belongings is recommended.

An elaborate experiment was carried on to ascertain the proper thickness of foundation to be used in securing the most attractive

combs. Eight varieties of foundation were used, and measurements made of the comb built upon them, which were compared with measurements of natural comb. It was found that no comb made from foundation equaled in fineness the natural, although it might closely approach it. The thinner foundation has a slight advantage over the heavier for producing light comb. Keeping foundation for a long time before using had but slight ill effect upon it.

Some general remarks are made upon preparing hives for winter, directions being given for clearing the supers of bees and removing the surplus honey, and preparing the sirup to be fed. Notes are given on some experiments in wintering bees in a cellar. The apartment proved to be too damp. About 20 per cent of the bees perished; few, however, dying from dysentery, contrary to expectation. Sealed covers produced no difference in the case of small colonies, but were slightly detrimental in weak ones. It is urged that all colonies be kept strong, doubling up in September if necessary.

To ascertain, if possible, the difference in value between sugar sirup and honey for winter stores, 24 colonies were selected in the fall, 12 being fed with each of these foods. The experiment lasted from September to April. It was found that sugar sirup was much more economical, the average consumption of sugar stores being 3½ lbs., while that of honey was 6½ lbs. Granulated sugar sirup is believed to be fully equal to the best honey, and superior and safer than inferior honey.

Six colonies were wintered out of doors, 3 of the hives being placed on top of the others. Four inches of shavings were packed all around the hives. Four of the colonies passed through the winter safely, emerging on warm days for short flights; but 2 of the colonies perished, probably during a blizzard in March.

Report of the consulting entomologist, G. C. DAVIS (*Michigan Sta. Rpt. 1891, pp. 85–93, figs. 5*).—This recounts the attacks of several species of insects in different parts of the State, giving notes upon their ravages, life history, and most efficient treatment. The spring cankerworm (*Paleacrita vernata*) was prevalent in orchards over most of the State, stripping many trees of their foliage before being checked. Spraying with arsenites was effective where practiced in time. The clover mite (*Bryobia pratensis*) was reported as entering houses in large numbers, where its presence was objectionable, although it caused no injury. Spraying the mites on the outside of the buildings with kerosene and the inside of the rooms with benzin is recommended. Army worms made their appearance in the southern and central part of the State, especially in newly cleared regions, but were attacked by at least 2 species of diptera, and only a small number escaped the onslaught of these parasites. Climbing cutworms were reported as damaging orchards in the fruit belt along Lake Michigan, and to limit their attacks is recommended banding the trunks of the trees with wool and sticking small limbs that have been poisoned with arsenites into the ground close to the

trunks of the trees. Four species were identified, *Mamestra subjuncta*, *Carneades scandens*, *C. messoria*, and *Nephelodes minans*. Several species of blister beetles proved damaging to garden crops, *Epicauta vittata* and *E. cinerea* to potatoes, *E. pennsylvanica* to sugar beets, and *Macrobasis unicolor* to Windsor beans. Spraying the plants with a solution of Paris green or dusting them with air-slacked lime and Paris green are stated to be efficient remedies. Brief notes are given on a scarabæid beetle (*Diplotaxis harperi*) as a strawberry pest, an unidentified dipterous larva that was found burrowing in raspberry canes, *Adimonia cavicollis* on cherry trees, and a curculionid destroying iris flowers.

New Mallophaga, V. L. KELLOGG (*California Acad. Sci., ser. 2, vol. 6, pp. 31-168, pls. 14*).—This consists of illustrated descriptions of 60 species of bird lice, 1 genus and 38 species being described as new. Special reference is made to a collection obtained from maritime birds of the Bay of Monterey, California. The paper is prefaced by general remarks on the relationships and life history of the Mallophaga, and synoptical keys for the species are included.

The probable origin and diffusion of Blissus leucopterus and Murgantia histrionica, F. M. WEBSTER (*Jour. Cincinnati Soc. Nat. Hist., 17 (1896), pp. 141-155*).

The cigar case-bearer of the apple, J. FLETCHER (*Canadian Ent., 28 (1896), No. 5, pp. 128-130*).—Notes on *Coleophora fletcherella*.

The cock chafer (*[British] Bd. Agr. Circ., Apr., 1896, pp. 3, figs. 3*).—Life history and remedial notes on *Melolontha vulgaris*. Destruction of the adults by beating from the trees onto tarred boards or sheets in the early morning, and combating the larvæ by constant cultivation are recommended.

Diabrotica vittata as a greenhouse pest, F. M. WEBSTER (*Ent. News, 7 (1896), No. 5, pp. 138, 139*).

The species of Lachnus feeding on the fir (Picea excelsa), N. CHOLODKOVSKY (*Zool. Anz., 19 (1896), No. 499, pp. 145-150*).

Weevil attacks in alfalfa fields, M. HOLLRUNG (*Fühling's landw. Ztg., 45 (1896), No. 12, pp. 388-392, dgm. 1*).—Descriptive, life history, and remedial notes on *Otiorhynchus ligustici*. The use of steep-sided trenches to protect fields and spraying with an arsenical mixture, for which the formula is given, are recommended.

Celery insects, G. C. DAVIS (*Michigan Sta. Rpt. 1894, pp. 140-169, figs. 20*).—A reprint of Bulletin 102 of the station (E. S. R., 5, p. 791).

The grape louse (Phylloxera vastatrix) (*Deut. landw. Presse., 23 (1896), No. 45, p. 396, figs. 7*).

An affection of linden trees, R. THIELE (*Ztschr. Pflanzenkrank., 6 (1896), No. 2, pp. 78, 79, figs. 3*).—The author describes a gall found on the flowers of *Tilia ulmifolia* and *T. parvifolia*, which is due to a dipterous larva, probably *Cecidomyia* sp.

Forest insects—some gall making coccids, C. FULLER (*Agl. Gaz. N. S. Wales, 7 (1896), No. 4, pp. 209-218, pls. 4*).

A pocket atlas of the useful and injurious insects of France, E. DONGÉ (*Atlas de poche des insectes de France, utiles ou nuisibles. Paris: Paul Klincksieck, 1896, pp. 111-150, pls. 72*).

Hot water as an insecticide, G. C. DAVIS (*Michigan Bd. Agr. Rpt. 1894, pp. 451-453*).—This is a short article advocating the employment of hot water against a number of insects when attacks are limited to few and small plants. Most insects are killed by water at a temperature of 130° to 135° F., while plants are not injured by water at 150°, and cabbages will endure 180°. Hot water is especially recommended against cabbage worms, rose chafers, yellow-lined currant bug, and some other species.

Insect control, G. C. DAVIS (*Michigan Bd. Agr. Rpt. 1894, pp. 453-460*).—This is a general paper, first delivered as a lecture at various farmers' institutes, and dealing

in a popular way with the principles of the application of insecticides, and in detail with the methods of applying each of the more important insecticides. The arsenites, kerosene emulsion, buhach and pyrethrum, bisulphid of carbon, crude carbolic acid, hot water, tobacco decoction, and white hellebore are included.

Mineral residues in sprayed fruit, R. C. KEDZIE (*Michigan Sta. Rpt. 1894, pp. 137-139*).—A reprint from Bulletin 101 of the station (E. S. R., 5, p. 793).

Report of the State entomologist of Norway for 1895, W. M. SCHÖYEN (*Christiania: 1896, pp. 36*).

FOODS—ANIMAL PRODUCTION.

Meats, composition and cooking, C. D. WOODS (*U. S. Dept. Agr., Farmers' Bul. 34, pp. 28, dgms. 4*).—This is a popular article. Animal and vegetable foods are compared and the structure of meat is explained.

Tables are given which show graphically the smallest and largest percentage of refuse in the different kinds and cuts of meat, and the largest and smallest percentage of water, fat, and protein in the edible portion of the different kinds and cuts of meat.

The texture (toughness), flavor, and digestibility of meats are briefly spoken of.

"The toughness or tenderness of meat is dependent upon the walls of the muscle tubes and the connective tissue. The flavor, however, depends largely upon the kinds and amounts of 'nitrogenous extractives' which the tubes contain. Pork and mutton are deficient in extractives, and what flavor they possess is due largely to the fats contained in them. The flesh of birds and of most game is very rich in extractives, which accounts for its high flavor. In general the flavor of any particular meat is largely modified by the condition of the animal when slaughtered, and by its food, age, breed, etc. . . .

"Comparatively little attention has been given to the percentages of the different meats which are digested, but the facts so far obtained seem to indicate that flesh of all kinds, either raw or cooked, is quite completely digested by a healthy man. Rubner found that when given in quantities of not more than 2 lbs. per day all but 3 per cent of the dry matter of roasted beef was digested by a healthy man. From other experiments roasted flesh seems to be rather more completely digested than either raw or boiled meat, but raw meat is more easily digested than cooked (boiled or roasted)."

The processes of boiling, stewing, roasting, and broiling are discussed.

"Among the chief objects of cooking are the loosening and softening of the tissues, which facilitates digestion by exposing them more fully to the action of the digestive juices. Another important object is to kill parasites, and thus render harmless organisms that might otherwise expose the eater to great risks. Minor, but by no means unimportant, objects are the coagulation of the albumen and blood so as to render the meat more acceptable to the sight, and the development and improvement of the natural flavor, which is often accomplished in part by the addition of condiments."

When it is desired to retain the juices of the meat, as in roasting or boiling, the meat should at once be exposed to high heat to coagulate the albumen of the surface and render it comparatively impervious.

In making soups and broths the aim is to extract as much as possible from the meat, and it should be subjected first to moderate heat.

Meat extracts are divided into three classes:

"(1) True meat extracts; (2) meat juice obtained by pressure and preserved, compounds which contain dried pulverized meat and similar preparations; and (3) albumose or peptose preparations, commonly called predigested foods.

"The true meat extract, if pure, contains little else besides the flavoring matters of the meat from which it is prepared, together with such mineral salts as may be dissolved out. . . . It is, therefore, not a food at all, but a stimulant, and should be classed with tea, coffee, and other allied substances. It should never be administered to the sick except as directed by competent medical advice. Its strong, meaty taste is deceptive, and the person depending upon it alone for food would certainly die of starvation. Such meat extracts are often found useful in the kitchen for flavoring soups, sauces, etc. Broth and beef tea, as prepared ordinarily in the household, contain more or less protein, gelatin, and fat, and therefore are foods as wells as stimulants. The proportion of water in such compounds is always very large.

"The preserved meat juice and similar preparations contain more or less protein, and therefore have some value as food.

"The third class of preparations is comparatively new. The better ones are really what they claim to be—predigested foods. They contain the soluble albumoses (peptoses), etc., which are obtained from meat by artificial digestion. The use of such preparations should be regulated by competent medical advice."

Diagrams are given which show the cuts into which beef, veal, pork, and mutton are usually divided. The functions of the nutrients of food are briefly stated, and tables are given showing the chemical composition and fuel value of a large number of meats and fish.

Tuberculous meat and milk. S. MARTIN and S. WOODHEAD (*Diet. and Hyg. Gaz., 12 (1896), No. 3, pp. 172–174; British Med. Jour.*).—Special inquiries were made for the British Royal Commission on tuberculosis, on the infectivity of food of tuberculous origin, and on the effect of cooking processes. In the authors' opinion, from observations made on 21 cows, the infectivity of meat does not depend on infective material present in the muscular tissue itself, but on contamination of the meat during dressing, by means of knife, cloth, etc., infected with tuberculous material. When the kidneys, pelvic glands, and other organs show that the disease is generalized the carcass should be condemned.

Milk is not regarded as harmful unless the udder is tuberculous. In such a case the milk, butter, and buttermilk are regarded as extremely dangerous, and the milk is very virulent. Tuberculous milk possesses the power of infection when mixed with considerable quantities of sound milk.

In cooking meat tuberculous material accidently present on the surface of a roast would ordinarily be destroyed, but if the roast is a roll the danger is not avoided, since the temperature in the interior seldom reaches 140° F. The authors state that if tuberculous milk is kept at a temperature of 183° F. for 5 minutes it is rendered innocuous, although it may be rapidly brought to a temperature of 194° and still

retain some power of infection. Experiment showed that scalding milk, as often practiced in the household, by placing the vessel containing the milk in another which contains water and bringing the water to a boiling point, was inadequate to sterilize milk. Brief directions are given for sterilizing milk.

The influence of tea, coffee, and cocoa on digestion, J. W. FRASER (*Sci. Amer.*, *71* (*1896*), *No. 17*, *p. 262*).—This is an abstract of an article published in a recent number of the *Journal of Anatomy and Physiology*. Artificial digestion experiments were made on the influence of tea, coffee, and cocoa on the digestion and assimilation of raw and cooked serum and egg albumen, raw and cooked myosin, syntonin, alkali albumen, casein, gluten, starch, and olein. The results obtained show that all three beverages retard the digestion of the nitrogenous constituents of foods when peptic and pancreatic digestion are taken together; they uniformly retard peptic digestion, though tea may assist the diffusion of peptones from the stomach. The pancreatic digestion is uniformly retarded and diffusion thereafter rarely assisted. In the author's opinion, therefore, neither tea, coffee, nor cocoa compares with water as a beverage for experimental investigations. The digestion of starchy food, in the author's opinion, appears to be assisted by tea and coffee. Gluten, the albuminoid of flour, is the substance least retarded in digestion by tea, while coffee has apparently considerable retarding action on it The digestion of meat and eggs is not much retarded by coffee. The author believes that a large part of the casein of the milk and cream taken with the beverages is absorbed in the stomach. Butter is thought to undergo digestion more slowly in the presence of tea, and more quickly in the presence of coffee. The use of coffee and cocoa as excipients for cod liver oil, etc., appears to depend not alone on taste, but on actual effect on the digestion of fats.

The influence of alcohol upon the chemical processes of digestion, R. H. CHITTENDEN and L. B. MENDEL (*Diet. and Hyg. Gaz.*, *12* (*1896*), *No. 5*, *pp. 289–298*).—This article is an extract from a paper published in the *American Journal of Medical Sciences*, April–June, 1896. A number of experiments were made on the influence of alcohol on gastric, pancreatic, and salivary digestion by artificial methods. The purely chemical processes of digestion were the subject of investigation.

The gastric digestion experiments were made with egg albumen and coagulated blood fibrin, pepsin-hydrochloric acid being used as a digestive mixture. "It is plainly manifest that in the presence of small amounts of alcohol (1 to 2 per cent of absolute alcohol) gastric digestion may proceed as well or even better than under normal circumstances. . . . This increased digestive action, though slight, occurs too frequently to be the result of mere accident, and apparently indicates a tendency for alcohol when present in small quantity to increase slightly the digestive action of pepsin hydrochloric acid." When the percentage of alcohol is increased a retarding action on digestion is observed. "With

15 to 18 per cent of absolute alcohol digestive action may be reduced one-fourth, or even one-third, the exact amount of retardation, however, being especially dependent upon the strength or activity of the gastric juice and upon the natural digestibility of the proteid material."

The pancreatic digestion experiments were made upon blood fibrin with neutral pancreatic juice extracted from dried pancreas by Kühne's method. A more pronounced retardation of digestion was observed than in the gastric digestion experiments. "As in the case with pepsin, the weaker the digestive powers of the pancreatic juice the greater the retarding power of absolute alcohol. . . . When the amount of alcohol present in the digestive mixture is less than 1 per cent the retardation of digestive action is very slight, provided the ferment is fairly vigorous in its action."

The salivary digestion experiments were made upon starch with saliva. "It is plainly manifest that absolute alcohol has very little influence upon the amylolytic or starch-digesting power of neutral saliva. Only when the saliva added to the digestive mixture is diluted in the proportion of 1 to 30 does the presence of even 10 per cent of alcohol have any measurable influence. . . . As this percentage of absolute alcohol is equal to at least 20 per cent of proof spirits, it follows that pure alcohol, free from admixture, is practically without influence upon the digestion of farinaceous foods by the saliva." These remarks apply to the change of starch into achroödextrin and maltose.

Other experiments were made by which the actual amount of maltose formed could be determined. It was found that small amounts of alcohol may actually cause an increased formation of maltose. "On the other hand, the presence of 10 or 15 per cent of absolute alcohol leads to a distinct retardation in the formation of sugar, although the inhibition is not very pronounced considering the amount of alcohol present."

Gluten feeds and meals, J. L. HILLS (*Vermont Sta. Bul. 48, pp. 63-78*).—The source and composition and process of manufacture of gluten feeds and meal are discussed. Tables are given showing the composition of gluten feeds and meals. Two tests were made to determine the value of King gluten meal and Chicago maize feed, compared with bran and corn meal, as a food for milch cows. The cows were Ayrshire, high-grade Jersey, and Jersey-Ayrshire cross. The first test was made in 1894 with 7 cows, and included 3 periods of 4 weeks each. A daily ration of 8 lbs. of a mixture of equal parts of bran and corn meal was compared with one containing 4 lbs. of the mixture and 4 lbs. of King gluten meal, on 4 cows in 3 periods, the rations being reversed in different periods. With 3 other cows 8 lbs. of maize feed was compared with 8 lbs. of the mixture of bran and corn meal, in the same manner. In addition, during the first period 8 lbs. of hay were con-

sumed per day, in the second period 6 lbs., and in the third period 4 lbs. Corn silage was fed *ad libitum.*

All the cows except 2 gained in weight. In every case the first 10 days of a period was considered a preliminary test, then for 6 days samples of the milk were taken; this was omitted for the next 6 days and resumed for the last 6 days.

The second test was made in 1894–'95 with 7 cows. The same grain rations were fed in the same way as in the first test. In addition each cow received daily 14 to 25 lbs. of hay. The milk was sampled as in the first test. In every case the uneaten residue of the food was weighed.

Tables are given which show the amount of each article of food eaten by each cow during the 18 days which formed the experimental period of each test. Tables are also given which show the amount of milk from each cow on the ration fed, and the amount of total solids and fat in the milk.

The differences in milk yield in favor of King gluten meal and Chicago maize feed over corn and bran are shown in the following table:

Difference in yield of milk in favor of King gluten meal and Chicago maize feed over corn and bran.

	King gluten meal.			Chicago maize feed.		
	Milk	Total solids	Fat.	Milk.	Total solids	Fat.
Total .... pounds	288	39 87	16.67	224	30 74	9.10
Average per cow .... do ..	41	5 70	2 [illegible]8	32	4 39	1.30
Increase .... per cent	10	11 00	13.00	10	10.00	10.00

The author draws the following conclusions:

"These experiments, together with those noted in the Sixth Annual Report (E. S. R., 5, p. 73), tend to show:

"(1) That cream gluten meal, King gluten meal, and Buffalo gluten feed each has a considerably greater feeding value, pound for pound, than has equal parts of corn meal and bran, while corn germ feed has about the same feeding value, and Chicago maize feed has little greater feeding value than has the corn meal and bran.

"(2) That the feeding of these by-products seems to produce a slightly richer milk, one in which the fat is disproportionately increased. The change, however, is not sufficiently marked to be of practical importance."

Free fatty acids in oil cakes and other feeding stuffs, B. DYER and J. F. H. GILBARD (*Analyst, 20 (1895), No. 236, pp. 211–216; abs. in Chem. Centbl., 1896, I, No. 3, p. 177; Centbl. Agr. Chem., 25 (1896), No. 4, p. 274*).—The authors have examined nearly 1,000 feeding cakes and flours and meals from various grains and seeds for free fatty acids. Linseed cakes, known to be pure and fresh, gave low percentages of free fatty acids, the average for 116 such being 3.1 per cent (expressed in terms of oleic acid) and the highest 12 per cent of the total oil present. Where impurities in the way of seeds of other plants were

present or where the cakes had heated and molded, the amount of free acids was noticeably larger. One hundred and seventy-eight English cakes averaged 4.2 per cent free acids, with a maximum of 30 to 40 per cent; 43 Russian linseed cakes gave an average of 10.6 per cent and a maximum of 20 to 30 per cent; 11 American averaged 11.1 and had a maximum of 20 to 25; 6 Indian averaged 16.6, with a maximum of 30 to 40; 84 undecorticated cotton cakes averaged 12.2 per cent and gave as high as 30 to 40 per cent of free acids, while 38 decorticated cakes averaged 7.5 and had as high as 15 to 20 per cent. Rape cakes, peanut cakes, niger seed cakes, maize products, rice meal, oat meal, wheat flour, and others were also examined.

The authors state, however, that the general bearing of the presence of much free acid in food appears "to be of but little consequence except in so far as it may indicate bad condition due to fermentation, which for other reasons may render food unwholesome;" since other foods, such as oat meal, rice meal, bran, various kinds of flour, dried grains, etc., of assured value in every day use, contain proportionally quite large amounts of free acid in the oily matter. Nearly three-fourths of the fat in 13 samples of rice and nearly one-half that in wheat flour was found to be present as free acid.—B. W. KILGORE.

The composition, digestibility, and food value of potatoes, H. SNYDER (*Minnesota Sta. Bul. 12, pp. 83-96, fig. 1*).—Some 20 specimens of potatoes grown on various soils in different parts of the State were analyzed, the average percentage composition being water, 75.45; starch, 19.87; fat, 0.08; fiber, 0.33; ash, 1.00; protein, 2.50; malic acid, pectose substances, etc., 0.77. In a diagram the average composition of the potato is represented graphically.

The composition of the potato is discussed at considerable length. The earlier varieties of potatoes are regarded as preferable for feeding purposes, because they contain less starch and more protein. Small potatoes contain more starch than larger ones. In the latter pectose replaces a part of the starch.

The nitrogen compounds are inferior as muscle formers to those in grains and milled products.

"In the potato only about half of the total nitrogenous compounds are in the form of protein, mostly vegetable albumen, while the other half is in less valuable forms, known as amids, etc. In the grains and mill products about 95 per cent of the total nitrogen is in the form of protein. Hence, in comparing the food value of potatoes with the food value of other materials, it is necessary to assign only half the value to the potato crude protein as to the crude protein of grains."

The amount of fat and crude fiber in potatoes is small. Glucose may be present in considerable quantity if the potato has begun to sprout or has been frozen, but is not present at all when the potato is first dug. The small amount of malic acid in the potato renders it more palatable.

"The mineral matter of the potato is composed largely of potash salts, which are present mainly in the juices. Although growing under ground, there is only a very

small amount of silica (sand) in the tissues of the potato, about the same amount as is present in the wheat kernel."

Digestion experiment (pp. 88–91).—Four separate trials with pigs were made. In 2 trials the potatoes were eaten raw and in 2 cooked. In each case 10 lbs. of potatoes and a little over 3 lbs. of shorts were consumed daily. The digestibility of the shorts was determined separately. The pigs weighed from 170 to 220 lbs. each and were allowed some exercise in a room with a tiled floor. Urine and feces were collected separately. The total, the albuminoid, and the biliary nitrogen were determined in the feces. The average digestibility of the dry matter, total nitrogenous matter, etc., of raw and cooked potatoes is given in the following table:

Average digestibility of potatoes.

	Total dry matter	Total nitrogenous matter	True protein	Starch, pectose, etc.	Ash.
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent.*
Potatoes, raw	97	81.[illegible]	82	98.1	44.6
Potatoes cooked	95	82.0	80	97.6	40.0

The pigs could be induced to eat a larger quantity of cooked than of raw potatoes.

"The range in digestibility of the dry matter, protein, starch, etc., of the potato is very limited. On account of the very small amount of fat in the potato, less than 0.1 per cent, it is not safe to calculate the absolute amount digestible. But from the high digestibility of the dry matter and the physical appearance of the fat when separated, it is safe to assume that the small amount of fat is also easily digested. The fiber is also calculated along with the starch and other non-nitrogenous compounds."

Considerable quantities of albumen may be lost in cooking potatoes. It was found by experiment that if peeled potatoes were started in cold water 80 per cent of the albumen was extracted, and if started in hot water 10 per cent. If the potatoes were not peeled the amounts extracted were 50 per cent and 2 per cent.

A liberal amount of salt is recommended with potatoes, since "the mineral matter of the potato is largely composed of potash salts and there is only a small amount of sodium chlorid present. In the excretion of the potash salts from the body a larger amount of sodium salt is required.

Food value of potatoes (pp. 91–96).—A table is given which shows the amounts of nutrients which may be purchased for $1 when potatoes are 8, 10, and 12 cts., corn 20 and 25 cts., oats 12 and 15 cts., and barley 30 cts. per bu., and bran $6 and $7, shorts $6 and $7, wheat screenings $5, and linseed meal $14 per ton; and also the digestible nutrients purchased when 50 cts. is expended for potatoes and 50 cts. for shorts, bran, oil meal, or screenings. When potatoes are 8 cts. per bu. and

shorts or bran $6 per ton, "50 cts. worth of potatoes and 50 cts. worth of shorts or bran will procure more food nutrients than if the dollar were expended for corn at 25 cts. per bu., or oats at 15 cts. per bu."

On the basis of previous experiments (E. S. R., 4, p. 733) it is stated that a pig weighing 250 lbs. must have 0.5 lb. protein, with digestible non-nitrogenous materials, in order to supply the needs of the organism. If 4 lbs. of shorts and 15 lbs. of potatoes are consumed daily the pig will receive 0.6 lb. of protein, an amount sufficient for maintaining the organism with a small margin for growth.

A table is given which shows the amount of grain or mill products to be fed with large rations of potatoes to pigs, growing cattle, fattening cattle, and sheep.

"For dairy stock it is doubtful, when foods are as cheap as they are at present, whether it would pay to feed very large quantities of potatoes, because a dairy ration necessarily requires more protein than a fattening ration.

"Potatoes can not be fed to young animals as safely as to more mature ones. If fed in too large quantities they have a tendency to prematurely fatten the animal and build up a lighter framework. With more mature animals, when the fattening period is largely a period of the addition of fat to the body, the potatoes can then be fed to advantage, and more economically."

The feeding value of silage, sugar beets, and mangels compared, H. J. WATERS, W. H. CALDWELL, and E. H. HESS (*Pennsylvania Sta. Rpt. 1894, pp. 61–71, pls. 3*).

Synopsis.—An experiment on the relative feeding value of silage, sugar beets, and mangel-wurzels for cows. Silage was found to produce a little more milk, butter fat, and solids-not-fat than the other feeding stuffs.

A trial of the relative feeding value of silage, sugar beets, and mangel-wurzels was made in 1893 with 3 lots of 3 cows each, the breeds represented being the Guernsey, Jersey, grade Jersey, Ayrshire, and Shorthorn. The work is in continuation of that reported in bulletin 26 of the station (E. S. R., 6, p. 446). The test was divided into 3 periods of 30 days each. During the first and third periods the cows were fed alike, the ration consisting of 9.75 lbs. of silage, 22.75 lbs. of sugar beets, 28.75 lbs. of mangel-wurzels, 6 lbs. of field-cured corn stover, and 8 lbs. of a grain mixture made up of 54.5 per cent Buffalo gluten meal, 27.3 per cent cotton-seed meal, and 18.2 per cent linseed meal.

During the second period all the lots received 8 lbs. of mixed grain (as in the first period), and 6 lbs. of corn stover per cow daily. In addition lot 1 received 27.88 lbs. of silage; lot 2, 64.13 lbs. of sugar beets, and lot 3, 87.88 lbs. of mangel-wurzels.

Tables are given showing the computed total digestible nutrients fed each lot for each period.

During the first period the weight of the cows did not change much. During the second and third periods there was quite a gain in weight.

The yield of milk, butter, and solids-not-fat for each lot in each period is shown in the following table.

Yield of milk, butter, and solids-not-fat.

	Milk.	Average fat content.	Butter.	Total solids.	Solids-not-fat.
Period 1, roots and silage combined:	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Pounds.*
Lot 1	1,713	4.63	95.6	13.19	146.6
Lot 2	2,059	4.34	102.5	13.05	179.3
Lot 3	1,756	4.67	92.1	13.16	149.1
Period 2, silage, sugar beets, and mangel-wurzels fed separately:					
Lot 1 (silage)	1,417	5.30	90.5	13.88	121.7
Lot 2 (sugar beets)	2,106	4.43	106.2	13.18	184.2
Lot 3 (mangel-wurzels)	1,684	4.73	87.6	13.20	142.5
Period 3, silage and roots combined:					
Lot 1	1,422	4.78	82.5	13.34	121.7
Lot 2	1,972	4.34	97.0	13.09	171.9
Lot 3	1,481	4.58	73.4	12.98	124.2

When the yield of milk, butter, and solids-not-fat is computed per 100 lbs. of digestible matter and period 2 is compared with the average of 1 and 3 the following results are obtained:

Average yield of milk, butter, and solids-not-fat of each lot per 100 lbs. of digestible organic matter consumed.

	Milk	Butter.	Solids-not-fat.
Lot 1 (silage):	*Pounds.*	*Pounds.*	*Pounds.*
Average of periods 1 and 3, mixed rations	117.6	6.7	10.0
Period 2	141.3	9.0	12.1
Lot 2 (sugar beets)			
Average of periods 1 and 3, mixed rations	153.7	7.6	13.3
Period 2	152.4	7.7	13.3
Lot 3 (mangel wurzels)			
Average of periods 1 and 3, mixed rations	130.9	6.7	11.0
Period 2	116.0	6.4	10.4

"From this summary it appears that there is a superiority of the cows constituting lot 2 over those of lot 1 in economy of production, as shown in period 1 when both lots were fed alike and with practically the same quantities of food, and of the cows of lot 3 over those of lot 1. . . . It will be seen that the lot receiving silage in the second period increased in milk, butter, and solids-not-fat . . . compared with the average of periods 1 and 3 when a mixture of roots and silage was fed." There was an increase in milk, fat, and total solids-not-fat when silage was eaten. "It is not clear, however, that this difference is altogether due to the superiority of silage over sugar beets and mangels, since there is so much difference in the amount of food consumed by the different lots that a direct comparison is unreliable. The presumption, however, is in favor of the silage."

Steer feeding: A well-balanced vs. a poorly balanced ration, R. H. MILLER and E. H. BRINKLEY (*Maryland Sta. Bul. 36, pp. 201–213*).

Synopsis.—Two tests were made with grade Shorthorn steers. In each trial one lot was fed a well-balanced ration and one lot a poorly balanced ration. The well-balanced ration was found to be more profitable.

These are tests in continuation of work previously reported in Bulletin 22 of the station (E. S. R., 5, p. 601). For the first trial (1894)

6 high-grade Shorthorn steers 2 years old, which had been dehorned as calves, were purchased, costing at the station $4.64 per 100 lbs. They were divided into 2 lots of 3 each. Lot 1 weighed 3,676 lbs. and lot 2 3,620 lbs. During a preliminary test, December 22, 1893, to January 13, each lot was fed a ration consisting of a mixture of 15 lbs. of corn-and-cob meal, 2 lbs. of cotton-seed meal, 2 lbs. of wheat bran, and 14 lbs. of shredded corn fodder, the fodder being moistened and the grain mixed with it. Each steer received 10 lbs. per day of this mixture. The feed was mixed 12 hours before it was used. Lot 1 lost 136 lbs. in weight and lot 2 131 lbs.

The feeding test was begun January 13 and lasted 91 days. Lot 1 was fed a mixture of 15 parts of corn-and-cob meal, 4 parts of cotton-seed meal, and 2 parts of wheat bran, "well balanced," and lot 2 was fed corn-and-cob meal, "poorly balanced." These rations were mixed with moistened shredded corn fodder, as in the preliminary period, and a little salt was added. It was the intention to feed the animals all the grain and fodder they would eat. The proportion of grain to fodder was changed from time to time to suit the appetite. In addition to the above ration, lot 1 was given 2 qts. of molasses per day for 7 days, and lot 2 2 qts. per day for 14 days. One steer also received 8 lbs. of potatoes per day.

The financial statement is based on corn fodder at $2.50, corn-and-cob meal $15, cotton seed meal $29, and wheat bran $19 per ton.

During the first 4 weeks lot 1 made an average daily gain per animal of 1.86 lbs. per steer; during the second 4 weeks, 1.19 lbs.; and during the third 4 weeks, 1.73 lbs. During the same time lot 2 made average daily gains of 1.39, 1.95, and 1.58 lbs., respectively. The average total gain of lot 1 for the whole period was 438 lbs.; for lot 2, 447 lbs. Lot 1 was sold for $4.37 per 100 lbs., at a loss of $39.62. Lot 2 was sold for $4.12 per 100 lbs., at a loss of $43.33.

During the test lot 1 drank 11,321 lbs. of water, and lot 2 12,634 lbs. "It will be noticed that the lot which drank the larger amount of water made the greater gain."

The fact that the steers "fed the poorly balanced ration made a better gain than those fed the more nitrogenous ration can in a large measure be attributed to the good condition of flesh and age of the steers at the time of starting the experiment. . . .

"There was less loss with the well-balanced ration, or, in other words, . . . the relative profits were in favor of a well-balanced ration."

For the second test (1895) 8 grade Shorthorn steers were purchased, costing at the station $4.15 per 100 lbs. During a preliminary test of 56 days' duration they were pastured and stabled at night, and were fed soft corn night and morning. The steers gained from 14 to 54 lbs. in weight. The feeding test, which began January 15 and continued 84 days, was made with two lots of 3 each. Lot 1 weighed 2,808 lbs., and lot 2, 2,728 lbs. The lots were fed the same rations as in the first test, and were given 10 lbs. of turnips per head daily in addition.

The financial statement is based on corn fodder at $2.50, corn-and-cob meal $15, cotton-seed meal $22, wheat bran $18, and turnips $4 per ton.

During the first 4 weeks the average daily gain per animal of lot 1 (well-balanced ration) was 3.83 lbs., during the second 4 weeks 2.67 lbs., and during the third 4 weeks 1.48 lbs. During the same time lot 2 (poorly balanced ration) gained 1.68, 1.95, and 0.88 lbs., respectively. The total gain of lot 1 during the whole period was 670 lbs., of lot 2, 388 lbs.

Lot 1 sold at 5¾ cts. per pound, giving a profit of $37.52. Lot 2 sold at 5¼ cts. per pound, giving a profit of $12.34.

During the test lot 1 drank 8,919 lbs. of water, and lot 2 7,179 lbs. "This difference represents quite a considerable amount of water, and may in a measure account for the appetite to consume a larger amount of food and consequently help to increase the gain of lot 1 over lot 2."

The conclusion drawn from the experiment is that the well-balanced ration is the more profitable.

A table is given which summarizes the results of these tests and the work previously reported.

"The results obtained during the first and third tests were nearly identical in every respect, and the gains in flesh and fat and the consequent increase in value gave a decided profit from a financial point of view for the well-balanced ration over the poorly balanced one. . . .

"Taking the average of the results for the 3 tests (10 steers), we find that the well-balanced ration gave a profit of $3.73 per steer, while the average for the 10 steers fed the poorly balanced ration resulted in a financial loss of $1.98 per steer."

From the results of the 3 feeding experiments the following conclusions are drawn:

"(1) That a well-balanced ration produced more gain and more profit than a poorly balanced ration.

"(2) Steers fed the well-balanced ration had a higher value per pound than those fed the poorly balanced ration.

"(3) That the ordinary corn-and-cob meal used by farmers was unprofitable and needed the addition of some highly nitrogenous food, such as wheat bran and cotton-seed meal, to make it profitable."

The bulletin also includes definitions of some of the terms used in describing feeding experiments.

The effect of food on the fat content of milk, J. SEBELIEN (*Molk. Ztg.*, *9* (*1895*) *Nos. 44*, *pp. 677*, *678*; *45*, *pp. 693*, *694*).—The author is convinced that, provided cows are properly nourished, the food has no effect on the percentage of fat in the milk. He states, furthermore, that there is not a single case on record in which the use of a particular feeding stuff has unquestionably increased the percentage of fat in the milk to a noticeable degree. He takes exception to the method commonly used in studying this question of feeding a number of cows in several periods, changing the ration from one period to another. He cites Fleischmann's experiments on 16 cows as showing that the variation in fat content of the milk from time to time, on the same

food, was much greater than many of the variations upon which deductions as to effect of change of food have been based. He prefers the method used by Fjord, in which uniform groups of a considerable number of cows are used, each group being fed a different ration, and the comparison made between groups. A number of Danish experiments on the question, made in this way, are cited: "While experiments by the period system on the effect of different feeding stuffs have given now a positive and now a negative answer, the Danish experiments, always made in a number of places on a uniform plan, have uniformly shown that it is possible to affect the milk yield by the food, but that the percentage composition of the milk is practically independent of the food." In these experiments concentrated feeding stuffs have been substituted for roots; grain has been, to a greater or less extent, replaced by oil cakes, including palm nut cake, which, according to Kühn, increased the fat, and wheat bran was substituted for a part of the grain feed. They cover 7 years, and were made in 10 different places in Denmark. They include 1,639 cows, divided into 161 groups, which, the author believes, make the results quite well founded.

The author also cites experiments by himself at the agricultural institute at Aas, Norway, with whale flesh meal, made according to the same method as the above experiments. The feeding of from 0.5 to 1.5 kg. of this meal, in some cases as a partial substitute for other feed, increased the yield of milk, especially at first, but in no case increased the percentage of fat. On the contrary, the group receiving the largest amount of whale flesh meal at times gave milk poorer in fat than the control group. This is attributed to the close ratio, which was 1:3.3, as compared to 1:4.7 with the control group. "The limit for nutritive ratio was passed, and the effect was apparent in the abnormal decrease in fat content of the milk." In spite of the very sharp characteristic odor of the whale flesh meal, there was no difference in the taste of the milk or butter, or the composition or keeping quality of the butter produced by the groups with and without the meal. It is stated as a fact that the "beet taste" and "turnip taste" of butter are not a result of the feeding of these roots, but are butter faults occurring frequently when the roots are not fed, and attributable to a microörganism. The work of Jensen[1] in support of this is cited.

The author fed a group of cows 1½ kg. of herring meal per head daily for 20 days without detecting any herring taste in the milk or butter. He concludes that the separate components of a normal ration have far less effect on the taste and quality of the milk and butter than is popularly believed.

Feeding wheat to pigs, E. D. PORTER, C. M. CONNER, and P. SCHWEITZER (*Missouri Sta. Bul. 29, pp. 1-20*).—These experiments, which cover a period of 90 days, were made with 13 lots of grade Berkshire pigs. The lots contained 2 or 3 pigs each, varying in age from 1

[1] Molk. Ztg., 6 (1892), Nos. 5 and 6.

to 6½ months. Each lot received a different ration, consisting usually of wheat, either whole or ground, fed wet or dry, and alone or in combination with corn, wheat, bran, potatoes, artichokes, or skim milk. The wet food was soaked in water for 36 hours. Each lot was confined in a roomy pen with a shelter, and was supplied with an abundance of clean straw, wood ashes, stone coal, and salt. The experiment lasted from November 16 to February 14. The lots were weighed every 10 days.

The details of the experiment are tabulated and summarized. The financial results are based on whole wheat at 55 cts., potatoes at 40 cts., and artichokes at 30 cts. a bushel; and wheat chop at $1, corn chop $1, and wheat bran 75 cts. per 100 lbs. The results are summarized in the following table:

Summary of results of feeding wheat to pigs.

Lot.	Ration.	Live weight. At beginning of trial.	Live weight. At end of trial.	Gain in live weight.	Food eaten per pound of gain.	Cost per pound of gain.
		Pounds.	*Pounds*	*Pounds.*	*Pounds*	*Cents.*
1	4 parts of corn chop 1 part of bran	415.5	787	371.5	5.13	4.88
2	2 parts of corn chop, 2 parts of wheat chop, 1 part of bran	400.5	762	361.5	5.40	5.09
3	4 parts of wheat chop, 1 part of bran	412.0	818	408.0	4.90	4.58
4	Wheat chop	394.0	894	500.0	4.33	4.36
5	Wheat chop, wet	400.5	940	539.5	4.13	4.17
6	4 parts of whole wheat, 1 part of bran, dry	406.0	768	362.0	5.13	4.71
7	4 parts of whole wheat, 1 part of bran, wet	396.5	730	333.5	5.93	4.98
8	Wheat chop and potatoes, boiled	521.5	761	239.5	[1] 3.30 [2] 8.20	[3] 9.50 ....
9	Wheat chop and artichokes, raw	528.0	728	200.0 300.0	[1] 3.25 [4] 8.20	[3] 6.65 ....
10	Whole wheat, dry	75.5	139	63.5	5.80	....
11	Wheat chop, wet	87.0	219	125.0	4.25	....
12	Wheat chop and skim milk, *ad libitum*	25.0	210	185.0	[1] 2.13 [5] 3.84	....
13	Corn meal and skim milk, *ad libitum*	24.0	[6] 139	115.0	[7] 2.25 [5] 5.30	....

[1] Wheat. [2] Potatoes. [3] Two months. [4] Artichokes. [5] Milk. [6] To February 4. [7] Meal.

The conclusions reached from these experiments were the following:

"Wheat as a food for growing pigs is superior to corn, weight for weight. Neither wheat nor corn give the best results when fed alone; both should be mixed with a food rich in nitrogen, such as peas. Very young pigs can not be reared at all on a clear wheat diet."

Pig-feeding experiments, C. A. CARY (*Alabama College Sta. Bul. 68, pp. 229–241*).

Synopsis.—Feeding experiments were made with 3 lots of pigs to determine the effect of crushed cotton seed and cotton-seed meal. It was the intention to investigate the cause of fatal results which often follow the feeding of cotton seed, but in these trials none of the pigs died. Several of those fed cotton seed were sick, and in general smaller gains were made on the cotton-seed rations than on those which contained no cotton seed.

The first test was made with 8 pigs and lasted 105 days, beginning April 28, 1894. The pigs were fed a variety of rations, containing corn

meal, ground cowpeas, wheat bran, crushed cotton seed, cotton-seed meal, sweet potatoes, green oats, and green sorghum, variously combined. All except Nos. 1 and 2 were fed differently. The gains in weight and the financial results are tabulated. By far the largest and the cheapest gains were made by the 2 pigs on ground corn, ground cowpeas, and sweet potatoes.

May 30 pig No. 7 (0.3 lb. cotton-seed meal) was sick and refused to eat. The rations were changed very soon after this. On August 4 the pig was again sick and grew worse until the end of the experiment, when it was turned out to pasture and recovered. Pig No. 8 (0.6 lb. cotton-seed meal) became sick May 30 and refused to eat, but gradually recovered. Toward the close of the experiment this pig was again sick, and, in the author's opinion, would have died if it had not been turned out and given other food. It soon recovered after the change.

The second trial, which was made with 10 pigs, began March 30, 1895, and lasted 91 days. Nos. 8, 9, and 10 were Essex pigs, the others of common stock. The following rations were fed:

No. 1. Corn 3½ lbs.
Nos. 2 and 3. Ground corn 2½ lbs., and crushed cotton seed 3½ lbs.
No. 4. Ground cowpeas 2½ lbs., and crushed cotton seed 4 lbs.
No. 5. Crushed cotton seed 4½ lbs.
No. 6. Crushed cotton seed 3½ lbs., and green rye 3½ lbs.
Nos. 7, 8, and 9. Crushed cotton seed 3 lbs., ground cowpeas 3 lbs., and green rye 3½ lbs.
No. 10. Wheat bran 3 lbs., and green rye 4 lbs.

Owing to an insufficient supply, the green rye was omitted after 28 days. At the close of the trial most of the pigs were pastured and fed corn until about January 1. The gains made before the change in rations, after the change in rations, during the whole period, the cost of 1 lb. of gain, and the weight after being in pasture are shown in the following table:

Gains made by pigs and cost of gain.

	Weight at beginning.	Gain in live weight.			Cost of 1 lb. of gain.	Weight Jan. 1.
		For 28 days.	For 63 days.	Whole period.		
	Pounds	*Pounds*	*Pounds.*	*Pounds.*	*Cents.*	*Pounds.*
No 1, corn	67 5	....	....	25.0	13.60	....
No. 2, ground corn and crushed cotton seed	47.0	....	....	11.5	32.00	216
No 3, ground corn and crushed cotton seed	60 0	....	....	23.0	16 00	164
No 4, ground cowpeas and crushed cotton seed	78 0	....	....	29.5	12.50	170
No. 5, crushed cotton seed	71 0	....	....	−13.0	....	153
No. 6, crushed cotton seed	70 0	−6.0	13.5	6.0	7 75	220
No. 7, crushed cotton seed and ground cowpeas	65.5	7.5	15.5	23.0	14.50	170
No. 8, crushed cotton seed and ground cowpeas	....	4 0	15.5	19.5	19.33	....
No. 9, crushed cotton seed and ground cowpeas	58.0	7.0	12 0	19 0	38.33	180
No. 10, wheat bran	60.0	10.0	9.0	19.0	19.40	203

None of the pigs were seriously sick.

The third test, which was made with 2 pigs, began July 15 and continued 98 days. For 48 days the ration consisted of 3½ lbs. of crushed

cotton seed and 6 lbs. of separated milk. It was the original intention to use separated milk during the whole period, but "owing to unavoidable circumstances whole milk was substituted for it" for the last 49 days of the trial. The weight at the beginning of the test, the gains made during the first 49 days, during the last 49 days, and during the whole period, and the cost of 1 lb. of gain are shown in the following table:

Gains made by pigs and cost of gain.

	Weight at beginning.	First half of trial.		Second half of trial.		Whole period.	
		Gain in weight	Cost of 1 lb of gain.	Gain in weight.	Cost of 1 lb of gain.	Gain in weight.	Cost of 1 lb of gain.
	Pounds.	*Pounds*	*Cents.*	*Pounds*	*Cents*	*Pounds.*	*Cents.*
No. 1	102	11½	21⅜	19	41⅓	30½	31½
No. 2	84	12½	20	8	98	20½	59

Twice during this test the pigs were somewhat sick, but never seriously affected.

No general conclusions are drawn regarding the harmful effects of cotton seed on pigs, but the opinions of other station investigators are quoted.

The economical production of pork, A. A. MILLS (*Utah Sta. Bul. 40, pp. 40, pls. 1*).

Synopsis.—Two series of experiments on the value of grass with and without grain, and its relation to exercise. Exercise was beneficial. Grass did not increase the gains enough to make feeding it profitable.

In 1894, 12 lots of 2 each were fed in different sized yards or in pasture, with or without grass, and with different amounts of a grain mixture, for a period of 91 days, as follows:

Lot 1. In pen with full grain ration without grass.
Lot 2. In pen with full grain ration with grass.
Lot 3. In pen with one-fourth grain ration with grass.
Lot 4. In pen without grain, grass alone.
Lot 5. In yard with full grain ration without grass.
Lot 6. In yard with full grain ration with grass.
Lot 7. In movable pen in pasture with full grain ration.
Lot 8. Loose in pasture with full grain ration.
Lot 9. Loose in pasture with three-fourths grain ration.
Lot 10. Loose in pasture with one-half grain ration.
Lot 11. Loose in pasture with one-fourth grain ration.
Lot 12. Loose in pasture without grain.

The grain was a mixture of equal weights of wheat, bran, and ground barley, and was fed wet.

At the conclusion of the 91-day period the lots were fed 70 days longer, all receiving a full grain ration. The results are summarized

in the following table, the barley being valued at $1 and the bran at 50 cts. per 100 lbs:

Results of feeding pigs grain rations with and without grass.

Lot.	Period 1.			Period 2.		
	Average per day per pig.		Cost of grain for 1 lb. of gain.	Average per day per pig.		Cost of grain for 1 lb. of gain.
	Gain.	Grain eaten.		Gain.	Grain eaten.	
	Pounds	*Pounds.*	*Cents.*	*Pounds.*	*Pounds*	*Cents.*
No. 1	1.33	6 28	3.52	0.96	6.54	4.80
No. 5	1.48	6.54	3.31	1.41	8.10	4.05
	1.39	6.41	3.41	1.18	7.32	4.42
No. 2	1.44	6.32	3.28	1.22	7 20	4.17
No. 6	1.31	6 19	3 53	1.23	7 44	4 26
No. 7	1.16	6 46	4.18	1.59	7.94	3 51
No. 8	1.65	7.00	3.17	1.27	7.35	4.09
	1.39	6 49	3.54	1.33	7.48	4 00
No. 9	1.23	5.24	3.19	1 62	9.28	4.03
No. 10	.85	3.55	3 12	1 71	9.03	3.73
No. 3	.35	1.62	3.51	2.11	9.91	3.30
No. 11	.61	1.77	2.18	1.96	9 07	3 48
	.48	1.69	2 84	2.03	9.79	3.39
No. 4	[1].26	....	....	1.92	8.42	3.07
No. 12	.37	......	....	1.96	8.60	3.12
	.11	....	....	1.94	8 51	3.09

[1] Loss.

In 1895 20 pigs were divided into 10 lots. Lots 1, 2, and 3 were fed in a small pen; lots 4 and 5, in a yard; and the remaining lots, fed in pens, were allowed to run in a pasture. During the first period, 60 days from June 29, lots 1 and 4 were fed a full ration without grass; lots 2, 5, and 6, a full grain ration with grass; lot 7, a three-fourths grain ration with grass; lot 8, a half grain ration with grass; lots 3 and 9, one-fourth grain ration with grass; and lot 10, grass without grain. A lot fed in a movable pen and a lot in a pen fed grass without grain were omitted in 1895, as they did so poorly in 1894. During the second period, 63 days from August 28, all the lots were fed full grain rations.

The average daily gain per animal, the grain consumed, and the cost of 1 pound of gain in each period is given in the following table:

Results of feeding pigs grain rations with and without grass.

Lot.	Period 1.			Period 2.		
	Average per pig per day.		Cost of grain for 1 lb. of gain.	Average per pig per day.		Cost of grain for 1 lb. of gain.
	Gain.	Grain eaten.		Gain.	Grain eaten.	
	Pounds.	*Pounds*	*Cents.*	*Pounds.*	*Pounds.*	*Cents.*
No. 1	1.16	4.75	2.97	1.49	6.67	3.13
No. 4	1.12	4.47	2.88	1.77	6.58	2.60
	1.14	4.61	2.92	1.63	6.62	2.86
No. 2	1.17	4.87	3.04	1.39	6.43	3.23
No. 5	.93	4.24	3.30	1.39	6.32	3.18
No. 6	1.34	5.19	2.81	1.61	6.92	3.01
	1.15	4.77	3.05	1.46	6.56	3.14
No. 7	1.19	3.92	2.39	1.69	7.07	2.84
No. 8	.89	2.58	2.10	1.90	7.28	2.69
No. 3	.29	1.22	3.04	1.30	5.84	3.14
No. 9	.66	1.29	1.43	2.07	7.41	2.50
	.47	1.25	2.23	1.68	6.62	2.82
No. 10	.35	....	....	2.05	7.73	2.63

The financial statement is based on wheat bran at 50 cts., and ground wheat 70 or 75 cts. per 100 lbs.

The principal conclusions drawn from these experiments and those previously made are the following:

"Pigs allowed to run at large over 18 acres of good pasture, and fed a full ration of grain, made the most rapid growth and required the least grain for 1 lb of gain. . . .

"Pigs at pasture, fed under 3 different conditions, gained 92.5 per cent more and ate but 2 per cent more than the pigs getting grass and otherwise similarly fed but confined in pens. The grain required to produce 1 lb. of gain was increased 40 per cent with those in pens over those at pasture.

"Pigs fed but part rations of grain at pasture made satisfactory gains. Those at pasture getting the three-fourths grain ration gained more than those fed a full grain ration and grass, either in the yards or in the pens. . . .

"As nearly as can be judged exercise alone increased the gain 22 per cent and the amount eaten but 1.5 per cent, but decreased the amount required for 1 lb. of gain 22 per cent.

"Grass when cut and fed green to pigs, whether fed in pens or yards, or with full or part grain ration, or without grain, proved to be of very little value.

"Pigs confined in pens and fed on grass alone, mostly lucern, for 91 days, lost over a quarter of a pound per day.

"The average of the pigs fed on grass gained a little more than those without the grass, but not enough to pay for the extra feed in the grass. . . .

"Pasturing either with full or with part grain rations appeared to be by far the cheapest and best way of making pork."

The study of human foods and practical dietetics, M. E. JAFFA (*California Sta. Bul. 110, pp. 19*).—The author summarizes views of different authors on the composition and digestibility of foods, dietaries, and dietary standards. The composition of a large number of food materials is quoted, and analyses of several samples of California foods are included in the tables. Using the data at hand the author shows how well-balanced dietaries may be calculated.

Horseflesh as human food (*Tidskr. Landtmän, 17 (1896), pp. 48–50*).

Cotton seed and its products (*U. S. Dept. Agr., Farmers' Bulletin 36, pp. 16*).—The topics treated of in this bulletin are cotton-seed products, cotton-seed oil, cotton-seed meal, cotton-seed hulls, cotton-hull ashes, and feeding cotton-seed products to farm stock.

Millet and millet by-products, W. BERSCH (*Landw. Vers. Stat., 46 (1895), No. 2–3, pp. 103–116*).—This paper gives a discussion of several species of millets used for feeding purposes, their culture, uses, composition, the preparation of food products from the seed, and composition of the resulting by-products used for feeding. The data appear to be mostly compiled.

Oil cakes as feeding stuffs and fertilizers, A. LARBALÉTRIER (*Les tourteaux des graines oleagineuses comme aliment et engrais. Paris: G. Masson, 1896, pp. 203*).

Adulteration of ground feed, R. C. KEDZIE (*Michigan Sta. Rpt. 1894, pp. 135–137*).—A reprint from Bulletin 101 of the station (E. S. R., 5, p. 794).

Rational stock feeding, H. P. ARMSBY (*Pennsylvania Sta. Rpt. 1894, pp. 36–43*).—This is a popular article, quoting average composition of American feeding stuffs and feeding standards. Methods of calculating rations are discussed.

Cotton-seed feed for dairy cows, H. P. ARMSBY and E. H. HESS (*Pennsylvania Sta. Rpt. 1894, pp. 44–63*).—Reprint of Bulletin 28 of the station (E. S. R., 6, p. 1014).

Cattle and cattle raising in South Drontheim County (Norway), J. AASENHUS (*Norsk Landmansblad, 15 (1896), pp. 205–211*).

Skim milk as a feed for milch cows (*Landmansblade, 29 (1896), pp. 193–195, 233, 234*).

The influence of the Ayrshire breed of cattle on Swedish dairying, S. FLACH (*Kgl. Landtbr. Akad. Handl. Tidskr., 35 (1896), pp. 55-63*).

Ongole or Nellore cattle, H. T. PEASE (*Indian Agr., 21 (1896), No. 6, pp. 172-174*).

The milk of the Chotzlower herd, G. KAISER (*Deut. landw. Presse, 23 (1896), No. 45, pp. 392, 393*).

Fattening lambs, F. B. MUMFORD (*Michigan Sta. Rpt. 1894, pp. 301-326*).—A reprint of Bulletin 107 of the station (E. S. R., 6, p 239).

Dairy and sheep farming at Superior, J. A. CRAIG (*Wisconsin Sta. Bul. 43, pp. 39-48, pls. 2*).—The local dairying and sheep-farming industry is discussed and methods of improvement suggested.

Cost of maintaining work horses (*Agl. Student, 2 (1896), No. 8, pp. 86-88*).—A record was kept of the hours of work performed and the cost of maintenance and care of each of the horses employed on the Ohio State University farm. The amount of food consumed was estimated approximately. The cost of stables, horses, and harnesses was not included. The total expense of keeping each horse was $84 per year. The average amount of work performed was 2,615 hours.

Practical help in horse breeding, W. VON HAFFNER (*Stockholm: 1896*).

The rôle of the posterior members of the horse in locomotion, LE HELLO (*Compt. Rend., 123 (1896), No. 23, pp. 1356-1360, figs. 2*).

The external conformation of the horse, E. A. A. GRANGE (*Michigan Sta. Rpt. 1894, pp. 364-395, pls. 3, figs. 2*).—A reprint of Bulletin 110 of the station (E. S. R., 6, p. 242).

Sunflower seed as a poultry feed, C. KNUDSEN (*Landmansblade, 28 (1895), pp. 774, 775*).

The poultry yard, a manual in poultry raising and egg trade, J. PEDERSEN-BJERGAARD (*Copenhagen: 1895, pp. 238*).

VETERINARY SCIENCE AND PRACTICE.

Parasitic ictero-hæmaturia of sheep, W. L. WILLIAMS (*Montana Sta. Bul. 8, pp. 212-220*).—This is a preliminary report upon a disease attacking sheep in the Deer Lodge and Silver Bow valleys and adjoining foothills and mountains since 1891, and killing on an average about 2,000 sheep annually. When an animal is attacked it moves listlessly and unsteadily, with arched back. A fever soon shows itself, the urine becomes bloody, and the skin and mucus membranes have a well-marked yellow color. Occasional dropsical swellings are to be found on the sides of the head and neck. The sick sheep lies in a crouching position most of the time, and almost invariably dies in from 1 to 5 days.

On *post-mortem* the blood was found to be thin and pale, and coagulating feebly. The liver was a little contracted, friable, and very yellow, while the gall bladder was usually distended with a yellowish-green or darker, thick bile. The kidneys were much enlarged, with easily detachable capsule and soft parenchyma, and the bladder was generally full of very dark, bloody urine.

By microscopical examination there was found to be a great decrease of red blood cells and a corresponding increase of white corpuscles. The red cells were enlarged, and contained from 1 to 4 round, oval, or oblong parasites, in length about one-tenth the diameter of the blood cell, actively motile, and frequently seen in the process of division. The disease is believed to be identical with one studied last year in

Italy by Dr. A. Bonome, and by him described as parasitic ictero-hæmaturia.

Further studies are to be carried on in the hope of arriving at a means of prevention and cure.

Scrotal hernia occurring in the stallion during and soon after castration and its cause, MASCHE (*Deut. landw. Presse, 23 (1896), No. 46, pp. 405, 406*).

On bloody urine (hæmaglobinuri, hæmaturi) in cattle (*Norsk Vet. Tidsskr., 7 (1895), pp. 49–52*).

On malignant œdema in cows, H. HORNE (*Norsk Vet. Tidsskr., 7 (1895), pp. 65–74*).

The effects produced on certain animals by toxins and antitoxins of diphtheria and tetanus injected in the rectum, P. GIBIER (*Compt. Rend., 122 (1896), No. 19, pp. 1075–1078*).

Contagiousness of foot and mouth disease among domestic animals (*Deut. landw. Presse, 23 (1896), No. 48, p. 429*).

The cattle plague, A. EDINGTON (*Agl. Jour. Cape Colony, 9 (1896), No. 10, pp. 253–255*).—A history of the disease and account of the present outbreak in Africa.

The value of tuberculin as a diagnostic agent for bovine tuberculosis, CHAUVEAU, LEBLANC, MÉGNIN, NOCARD, STRAUS, TRASBOT, and WEBER (*Jour. Pharm. et Chim., ser. 6, 16 (1896), 111, No. 9, pp. 438, 439*).

Tuberculosis of cattle, L. PEARSON (*Pennsylvania Sta. Rpt. 1894, pp. 89–123*).—A reprint of Bulletin 29 of the station (E. S. R., 7, p. 709).

Regulations of official tuberculin tests in Norway (*Norsk Vet. Tidsskr., 7 (1895), pp. 90–92*).—The government in 1895 appropriated 10,000 kroner ($2,680) for defraying the expense of an investigation of tuberculosis among farm animals. The tests are made free of charge upon application to the Department, the owner agreeing to quarantine all unhealthy animals and to observe other regulations stipulated in the announcement. Applications were received and accepted from 972 herds with about 12,250 animals.—F. W. WOLL.

Report of the Veterinary Laboratory of Norway for 1894, O. MALM (*Norsk Vet. Tidsskr., 7 (1895), pp. 109–117*).

The Royal Danish Veterinary School and Agricultural College, 1773–1895 (*Mdskr. Dyrlæger, 7 (1895), pp. 417–430, figs. 4*).—A brief history of the highest Danish agricultural educational institution from its establishment in 1773 up to the present time.

The fungus diseases of fish, A. MAURIZIO (*Ztschr. Fischerei, 1895, No. 6; abs. in Hedwigia, 35 (1896), No. 3, pp. 76, 77*).

Concerning parasitic worms in fresh-water fish, F. ZSCHOKKE (*Centbl. Bakt. und Par. Med., 19 (1896), No. 21, pp. 815–825*).

DAIRYING.

Pasteurization of milk and cream for direct consumption, H. L. RUSSELL (*Wisconsin Sta. Bul. 44, pp. 48, figs. 12*).—This bulletin gives a full discussion of the subject of pasteurization of milk and cream, the conditions to be observed in pasteurizing, the apparatus necessary for pasteurizing on a large and small scale, bottling, cost of the operation, etc.

The difference between pasteurizing and sterilizing and the relative advantages of each are pointed out. The distinction is made that—

"Pasteurization is the use of heat at a temperature ranging from 140 to 175° F., and is usually applied for only a limited length of time.

"Sterilization is the employment of a higher temperature, approximating if not exceeding the boiling point of water (212° F.).

"Milk that has been sterilized is not necessarily sterile, *i. e.*, completely free from all living germs, and therefore this term is, in a certain sense, a misnomer. . . .

"The resistance of bacteria in a latent condition (spores) that are always to be found in milk is so marked that no single heating process can be relied upon to free this material entirely from germ life, unless the sterilizing process extends over several hours."

In his discussion of conditions to be observed in pasteurizing milk on a commercial scale, the author makes the following observations on the selection of milk:

"Milk which has stood from 12 to 24 hours and has developed a considerable degree of acidity is not as well suited for pasteurizing as fresh milk. The development of acid is dependent upon the growth of the bacterial germs in the milk, principally the lactic-acid group of organisms; consequently, milks that show much acid are full of bacterial life. . . .

"The older the milk the richer it will be in spores, and consequently the pasteurizing process will have less effect on the contained bacteria. We have found in a practical way that the milk and cream that was treated on Monday often soured sooner than that of any other day in the week. In fact, it sometimes happened that milk pasteurized on Monday failed to keep as long as that which was pasteurized on the Saturday previous. This was due to the larger number of bacteria in a spore condition in the older milk. . . .

"For pasteurizing purposes, the nearer we can get the milk to the cow the better will be the result. Under some conditions milk can be shipped into the city without much loss of time, but where this can not be done, it is far better to handle the product in the country and ship it in a pasteurized condition than it is to transport it in the untreated state.

"The night and morning milk should be kept in separate cans, and during the extreme hot weather in the summer it may sometimes be necessary to reject the evening milk unless it has been handled with especial care."

Where milk is received from a number of patrons for pasteurizing purposes, it is suggested that the acidity of the milk be determined by means of the Farrington alkaline tablets, as an indication of the age and condition of the milk.

As to the temperature for pasteurizing, two factors enter in—the biological requirement and the physical requirement. The thermal death point of vegetating bacteria depends upon the temperature of heat used and the length of exposure to the heat. While most kinds of bacteria in the vegetating stage are killed by a moist heat of 133–140° F. for 10 minutes, a higher temperature is required for tubercle bacilli. The latter is said to be destroyed by a temperature of 149° F. for 30 minutes, 155° for 15 minutes, or 167° for 10 minutes. If milk is exposed to too high a temperature a permanent cooked flavor is imparted to it. Milk or cream nearly always has this flavor in pasteurizing at a temperature above 149° F. for 20 minutes, but the taste disappears quickly on cooling.

"We have usually chosen in our work the temperature of 155° F. as the proper pasteurizing point. With this medium temperature there is less danger of overheating than there is where the highest possible degree is used as a standard. With

this temperature an exposure for 15 minutes would be fatal to the consumptive germ, but in order to have a margin of safety, it has been our practice to extend this time limit to at least 20 minutes."

According to the author, the cooling of the pasteurized material is nearly or quite as important as the heating, for if the milk is allowed to cool spontaneously it soon reaches a temperature which is very favorable for the germination and growth of the few resistant bacteria that have not been killed by the heating. If left to itself it will require several hours for any considerable mass of milk to cool off to the temperature of the air about it, and except in winter months it should be cooled much below the ordinary room temperature. A diagram is given showing the necessity for rapid cooling of milk. This brings out the fact that the bacterial changes that occur in milk are directly dependent upon the length of time that the milk is kept at the temperature where growth can occur. "In order to preserve its keeping qualities after it is once pasteurized, milk should be chilled immediately to a temperature below the germinating point"—50° F., and except in winter months ice is necessary in the later stages of the process. Another benefit from rapid cooling is said to be the effect of sudden changes in temperature upon the vitality of the remaining spores. A rapid heating followed by rapid cooling has a greater paralyzing effect upon the vitality of the spores than more gradual changes in temperature; and to further increase the paralyzing effect of this chilling process it is recommended to hold the pasteurized product for some time at a low temperature. The result is more satisfactory where the pasteurized milk is kept at a low temperature for some hours instead of delivering it immediately to customers.

"To get the best results from pasteurized material it is necessary to keep it at all times at a low temperature. The maintenance of this condition prevents the development of the spores that are left in the milk to a great extent so that pasteurized milk and cream kept at 45° to 50° F. (refrigerator temperature) will remain sweet from 4 to 7 days or even longer. We have had cases where the milk was pasteurized but a single time and yet it remained sweet for over 4 weeks when the bottle was kept sealed. In our practical pasteurizing work we have made it a practice to expose a sample of each lot of cream that was handled to the temperature of the room and then note the length of time that elapsed before souring. In no instance have we found that the milk curdled in less than 2 days, and usually it kept from 3 to 4 days, even though the temperature of the room rose to 75° F. at times during the day."

A simple pasteurizing apparatus for family use, similar to that described in a circular of this Department, consists of a large tin pail with an inverted perforated pieplate as a false bottom. The bottles of milk are placed in the pail, water filled in the pail to the level of the milk, heated to 160° F., then removed from the fire and allowed to stand with the cover on for half an hour. The bottles are then removed and cooled as rapidly as possible and placed in a refrigerator. "Milk treated in this way ought to keep perfectly sweet for several days."

The apparatus on the market for pasteurizing on a commercial scale is discussed in a general way. Nothing was found which seemed to fill all the requirements, and experiments were made at the station which resulted in devising a combined pasteurizing and cooling apparatus. This apparatus is described and figured in detail. Briefly, it consists of 2 chambers, the inner a milk reservoir and the outer a water jacket. Each chamber is provided with stirrers to agitate the liquids and equalize the temperature. A special stopcock for drawing off the liquid is described and figured. The heat is furnished by a steam pipe which enters the water jacket at the bottom. Cold water may also be introduced through this pipe for cooling. The agitators are run either by steam or hand power. The milk or cream is filled in the reservoir, water filled in the water jacket to the same height, and rapidly heated to the required temperature, the agitators being run from the first. The temperature readings of both water and milk are taken at frequent intervals. The required temperature is maintained for about 20 minutes, after which the pasteurized material is rapidly cooled, either in the same apparatus or in a separate cooler. Water and ice coolers and devices for bottling are described and illustrated, together with a steam sterilizing apparatus for sterilizing the bottles and implements used in pasteurizing.

The details of pasteurizing milk or cream are given, with the precautions to be observed. The material is put up for delivery in a simple milk bottle closed with a plain pulp cap which is dipped in paraffin to seal the bottles.

The cost of the operation is discussed in a general way, but as the work has been done in connection with the general creamery no definite figures are given. It is believed, however, that under ordinary conditions the cost could not exceed more than a few cents per gallon where a business of any magnitude was carried on.

"So far as our present knowledge goes, pasteurized material is adapted to any use for which normal milk and cream is suitable. For general domestic purposes it gives excellent satisfaction, and ice cream made from it has a smoother texture than when the raw material is used. It has met with favor as an invalids' and children's food and is receiving the recommendation of medical men. Treated in the way detailed in the foregoing pages, the destruction of germ life in the milk averages about 99.7 per cent, and the effect of stopping the putrefactive and fermentative processes of so much organic life can not be attended with other than beneficial results. *

"With cream the cost of preparation is merely nominal, and although with milk it is proportionally more, owing to the intrinsic lesser value of the latter material, yet the increased value of the product much more than compensates for the expenditure.

"In view of the economic and hygienic advantages to be derived from pasteurized milk and cream it would not be surprising if it came into general use, especially in city trade."

The sterilization of milk, J. A. FORRET (*Pharm. Jour. and Trans.*, *4 (1896), No. 1346, p. 281*).—The author has examined various methods for the sterilization of milk and finds that the best results are obtained by placing the jar containing a pint of milk into a tin vessel filled with

3 pints of water in such a manner that the water and milk are at about the same level when the jar is supported about half an inch from the bottom. The water is then heated until it boils, after which the milk is allowed to remain in the water for 15 minutes. The water should boil in not less than 25 minutes and the milk must be stirred continuously to prevent the separation of the cream.—W. H. KRUG.

Cheese curd inflation, its relation to the bacterial flora of foremilk, H. L. BOLLEY and C. M. HALL (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 22–23, pp. 788–795*).—The word "foremilk" is used to mean the milk from the first part of a milking, not colostrum. Some studies were made on the formation of "pin holes" in curds which indicated it to be due to the action of bacteria. "Experienced cheese makers have quite generally affirmed that its chief origin is 'dirty milk.' The work upon which this paper is based reaffirms this belief." Preliminary cheese curd and fermentation tests were made at 2 different times with the milk of 2 cows, using the milk drawn first, the strippings, and the mixed milk of the whole milking. "The evidence from these tests is that the gas-originating organisms were not located in the udders either in the fore or last milk, and that the few 'pin-holes' of the curds must have had an external origin."

Studies were then made of the bacterial flora of the milk of 10 healthy cows, living under healthy stable conditions, from January 22 to April 25. In each case samples were taken of the first and last milk of the milking by means of a sterile silver milking tube inserted well up into the milk cistern. As a result, 16 distinct species of bacteria were isolated, some of which were common to both the first and last milk, and others to only one of these. All the microörganisms found were bacteria, and none were found which produced gas. "The work is given as a preliminary study, and may be said to indicate—(1) no bacterial flora common to the animals investigated, save one peculiar non-milk affecting species; (2) that a given form when once present may be quite constant in its occupancy of the udder of an individual animal. Finally, the absence of gas producing organisms remains unexplained, but adds significance to the previously described curd tests."

The constancy of the kinds of bacteria in normal milk, H. L. BOLLEY (*Centbl. Bakt. und Par. Allg., 1 (1895), No. 22–23, pp. 795–799*).—During the summer cultures were made of the milk drawn from each teat of 3 cows. The samples of milk were obtained in the same way as in the preceding studies, except that in some cases the milking tube was inserted to different depths. About 60 cultures were made. In all 37 different kinds of bacteria were found representing various physiological types. "As in the previous studies, there is no evidence that the same species are common to different animals, but the constancy of the occurrence of certain types, if present at all, is very apparent. . . . It is plain that the greater number of the germs are found only accidentally at a certain time in a given udder or teat, and perhaps come

from the surroundings of the animal. But there are certain single germs which if once found in a teat or udder reappear with a striking constancy."

Effect of shearing on the yield and composition of milk of milk sheep, HUCHO (*Milch Ztg., 25 (1896), No. 23, p. 360*).—There was a greater or less effect in the case of the 3 sheep used in the experiment. The yield of milk decreased and the percentage of solids and fat increased after shearing.

The production and sale of milk in the vicinity of Copenhagen, N. HEYMAN (*Landmansblade, 29 (1896), pp. 13–20, 31–38, 47–50*).

Preservation of cream for market, F. L. RUSSELL (*Maine Sta. Bul. 23, 2d ser., pp. 4*).—Popular remarks on the souring of cream; the method of destroying the germs and preventing souring by the use of heat, cold, and germicides; the injury to health of boric acid and salicylic acid; and pasteurization. It is stated that the creamery trade for Maine considerably exceeded $150,000 the past year.

The commercial and nutritive value of butter and cheese, K. SONDEN (*Nord. Mejeri Tidn., 11 (1896), p. 87*).

The practical importance of recent bacteriological researches for the manufacture of butter and cheese, N. ENGSTRÖM (*Kgl. Landt. Akad. Handl. Tidskr., 35 (1896), pp. 3–21*).

Tests of cream separators, H. P. ARMSBY, W. H. CALDWELL, and L. E. REBER (*Pennsylvania Sta. Rpt. 1894, pp. 13–35*).—A reprint of Bulletin 27 of the station (E. S. R., 6, p. 940).

De Laval milking machine (*Molk. Ztg., 10 (1896), No. 11, p. 168*).—According to a note from the *Swedish Patent Gazette*, the apparatus, "Lactator," weighs 14 lbs. and is connected with the cow by means of a hose which fits the teats. It gives the pulsating action of the sucking calf. The milk is pumped up into a can which is at about the height of the cow's head. The machine is said to operate quietly and steadily. It is being used regularly on a herd of 23 cows and is said to do satisfactory work.

The lactator (the milking machine invented by Dr. G. de Laval) (*Nord. Mejeri. Tidn., 11 (1896), No. 7, pp. 75, 76, illus.*).

Directions for using the Babcock test, H. HAYWARD and M. E. McDONNELL (*Pennsylvania Sta. Bul. 33, pp. 13, figs. 5*).—This bulletin gives popular directions for carrying out this test with whole milk, skim milk, and cream, and contains an offer to supply tested apparatus at a fair price to enable persons to have a standard with which other apparatus may be compared.

Dairying in Denmark during 1895, B. BOGGILD (*Tidsskr. Landokon., 15 (1896), pp. 144–155*).

Dairy farming in India (*Indian Agr., 21 (1896), No. 3, pp. 89, 90*).

Development and extent of dairying in transmarine countries: I, United States; II, Australia (*Milch Ztg., 25 (1896), Nos. 19, pp. 295, 296; 22, pp. 340, 341*).—Milk supply of New York and Chicago.

TECHNOLOGY.

Sirups and molasses, G. L. TELLER and J. F. MOORE (*Arkansas Sta. Bul. 37, pp. 181–186*).—A considerable number of sirups, such as are ordinarily sold in Arkansas, were collected, "without reference to their probable adulteration," and analyzed. The sirups were of four classes—(1) sugar-cane sirup, (2) maple sirup, (3) sorghum sirup, and (4) glucose sirup. The data for 25 samples of sirups are given, and the nutritive value of various sorts of sugar is briefly discussed. In the

authors' opinion this varies very little. "It may be said that the relative value of different sirups is largely dependent upon the individual taste of the consumer, and that the selling price has no relation to the actual food value of this article."

The production of maple sugar, G. H. GRIMM (*Cult. and Country Gent., 61 (1896), No. 2247, p. 146*).—The author urges the necessity of absolute cleanliness in everything connected with the process; the sap should come in contact with tin only; tin spouts should be used; and the buckets should be covered. The sap should be evaporated as soon as possible after it leaves the tree. With suitable apparatus a barrel of sap can be converted into a gallon of sirup weighing 11 lbs. in 20 minutes. This sirup will make 8 lbs. of sugar. The natural color of the sirup is a translucent white; if it weighs less than 11 lbs. per gallon it will ferment; if more, it will crystallize. The sirup is far superior to that from remelted sugar.

In putting it up for the market it should be poured into tin cans at 150° F., and hermetically sealed. It will keep better in an attic than in a cellar, unless the cellar is very dry.

The manufacture of beet sugar in Sweden, 1894–'95 (*Tidskr. Landtmän., 17 (1896), pp. 64–66*).

The infectious diseases of wines, J. BEHRENS (*Centbl. Bakt. und Par. Allg., 2 (1896), No. 6–7, pp. 213–231*).—A résumé and bibliography of this subject.

Hemlock for tanneries (*Garden and Forest, 9 (1896), No. 432, pp. 222, 223*).

The tannins of some Ericaceæ, B. L. DEGRAFFE (*Amer. Jour. Pharm., 68 (1896), No. 6, pp. 313–321*).

The tannin of the palmettos, H. TRIMBLE (*Garden and Forest, 9 (1896), No. 428, pp. 182, 183*).

The future supply of India rubber (*Indian Agr., 21 (1896), No. 4, pp. 125, 126; from Indian Rubber World*).

STATISTICS.

Danish agricultural statistics for 1894–'95, F. RECK (*Tidskr. Landökon., 15 (1896), pp. 168–194*).—The author gives summaries and discussions of Danish agricultural exports and imports during 1894–'95, as well as comparisons between statistical data for this and previous years. The following table shows the excess of the exports over the imports for 1894–'95 and the average for the preceding 10 years:

Excess of exports of Danish agricultural products over imports.

Products.	1894–'95	Average 1884–'94.	Products	1894–'95.	Average 1884–'94.
Horses..........number.	12,218	8,697	Eggs ...... million doz	11.14	9.00
Steers and cows ... do....	119,254	85,797	Wool ....million lbs..	1.41	13
Calves...............do...	2,085	5,868	Cereals .. million bush..	16.47	6.97
Sheep and goats ....do....	8,143	34,362	Bran ....do....	200.96	201.64
Swine ....do....	173,221	133,810	Oil cakes ....do....	197.08	127.42
Meat.........million lbs..	5.74	2.23	Rape and linseed ..do....	.84	.70
Pork ....do....	109.40	59.40	Artificial fertilizers, million lbs	50.02	43.54
Butter..............do....	88.00	60.58	Manures .. million lbs..	20.33	11.64
Cheese ....do....	1.72	1.15			

The exportation of pork and bacon increased considerably over that in 1893–'94, viz, 120.89 million lbs. in 1894–'95, against 102.52 million lbs. in 1893–'94, an increase of about 18 per cent. The excess of exports over imports of butter decreased from 91.02 million lbs. in 1893–'94 to 87.99 million lbs. in 1894–'95; the exports of butter during the latter year amounted to 127.29 million lbs., 124.56 million lbs. of which were sent to Great Britain. The average price paid for first-class Danish butter was 31.1 cts. per pound during 1894–'95, against 28.8 cts. during the preceding year.—F. W. WOLL.

Eighth Annual Report of Georgia Station, 1895 (*Georgia Sta. Rpt. 1895, pp. 421-429*).—A brief report on the work of the year, list of bulletins published, and a financial statement for the fiscal year ending June 30, 1895.

Seventh Annual Report of Michigan Station, 1894 (*Michigan Sta. Rpt. 1894, pp. 69-436*).—This consists of a treasurer's report for the fiscal year ending June 30, 1894; short reports by the director, agriculturist, horticulturist, botanist, entomologist, chemist, and apiarist, and reprints of Bulletins 101-110 of the station, Special Bulletins 1 and 2, and press bulletins on the army worm, prickly lettuce, prevention of stinking smut of wheat, Russian thistle, and doubtful substitutes for clover. Accounts of some hitherto unprinted work are noticed elsewhere.

Second Annual Report of Montana Station, 1895 (*Montana Sta. Bul. 8, pp. 191-220*).—This includes a treasurer's report for the fiscal year ending June 30, 1895; brief general reports by the director, horticulturist, agriculturist, and botanist, chemist, irrigation engineer, and veterinarian, and an article on parasitic ictero-hæmaturia of sheep (see p. 986). The acreage and yields are given of a number of farm crops grown at the station and crop statistics for Gallatin County.

Reports of director and treasurer of Pennsylvania Station for 1894 (*Pennsylvania Sta. Rpt. 1894, pp. 7-12*).—Brief notes by director on work of the station, changes in personnel, and publications, and a financial statement for the fiscal year ending June 30, 1894.

Annual Report of Ultuna Agricultural Institute 1893 (*Upsala (Sweden), 1894, pp. 165*).

Annual Report of Ultuna Agricultural Institute 1894 (*Upsala (Sweden), 1895, pp. 122*).

Report of the Royal Swedish Agricultural Academy for 1895, C. LOVIN (*Kgl. Landtbr. Akad. Handl. Tidskr., 35 (1896), pp. 21-33*).

American agriculture, N. HEYMAN (*Landmansblad, 29 (1896), pp. 65-71, 91-93, 101-104, 115-120, 131-134, 147-150*).

NOTES.

ALABAMA COLLEGE AND STATION.—L. M. Underwood, having been called to the professorship of botany in Columbia University, New York, has resigned the chair of biology; and F. S. Earle has been elected professor of biology and horticulture and biologist of the experiment station to succeed him. J. F. Duggar, who has been acting agriculturist since January 1, has been elected professor of agriculture and agriculturist of the station. C. F. Baker, formerly of the Colorado Station, has been appointed entomologist of the station and assistant in horticulture. A new greenhouse with glass area 20 by 80 ft. has been completed on the station ground, and F. Fremin has been employed to take charge of this and the phyto-pathological house.

CONNECTICUT STORRS STATION.—C. S. Phelps, agriculturist of the station, succeeds C. D. Woods as vice-director of the station, and F. G. Benedict takes his place as chemist. W. L. Pentecost succeeds Mr. Stocking as assistant agriculturist. James S. Judd, son of Orange Judd, has been appointed secretary of the station.

DELAWARE COLLEGE. George A. Harter, M. A., Ph. D., has been elected president of the college, vice Dr. A. N. Raub.

IDAHO STATION.—The citizens of Moscow and vicinity have donated to the university for exclusive use of the experiment station and agricultural college 80 acres of land. The tract is well suited to the investigation of many questions concerning the adaptability of North Idaho soil for agricultural purposes. It contains north, south, and east slopes, as well as hill and bottom land.

ILLINOIS UNIVERSITY AND STATION.—At a recent meeting of the board of trustees of the University of Illinois 2 new departments were established for the college of agriculture, viz, agricultural physics and dairy manufactures. Both of these positions are to be filled before the beginning of the college year in September. This provides for separate instructors for animal husbandry, soils and crops, and dairying. The same organization and the same men will also serve the station. The dean of the college of agriculture has been made *ex officio* director of the station, and the board of direction, which has hitherto served in the capacity of director, is retained as an advisory board.

MISSOURI UNIVERSITY AND STATION.—N. O. Booth, B. Agr., has been appointed assistant in horticulture at the station. Arrangements have been perfected for a school of horticulture devoted primarily to the practical technique of nursery work, orcharding, market gardening, and floriculture, to open January 5 and continue 12 weeks. This course will run parallel with the short winter course in agriculture, and will embrace horticulture and entomology as majors, and physiological and systematic botany, agricultural chemistry, bookkeeping, and shop work as minors.

OKLAHOMA STATION.—L. L. Lewis, D. V. M., formerly demonstrator of anatomy and house surgeon in the Iowa Agricultural College, has been appointed veterinarian at this station and entered upon his duties July 1.

RHODE ISLAND STATION.—H. F. Adams, farmer, and S. Cushman, apiarist and poultry manager, have resigned their positions at the station.

SOUTH DAKOTA COLLEGE.—John W. Heston, A. M., Ph. D., LL. D., has been elected president of the college and assumed the duties of his office.

UTAH COLLEGE AND STATION.—At a recent meeting of the board of trustees J. M. Tanner, of Salt Lake City, was elected president of the college, vice J. H. Paul; Luther Foster, M. S. A., late of Montana College and Station, director of the station; and Louis A. Merrill, B. S., assistant agriculturist. Ripley S. Lyon is now treasurer in place of H. E. Hatch, resigned. Profs. A. A. Mills and E. S. Richman have severed their connection with the college and station.

WYOMING COLLEGE.—W. F. Gilkison, of Colorado College, has been appointed instructor in mechanics in the College of Agriculture and Mechanic Arts.

PASTEUR MONUMENT.—It has been decided to erect in one of the squares of Paris a monument to the memory of M. Pasteur, and subscriptions are now being solicited for that purpose. The Paris committee includes the President of the Republic and his cabinet, together with about 160 of the most prominent officials, scientists, and other distinguished citizens of France. The committee has extended an invitation to the people of the United States to assist in this undertaking and have authorized the organization of the Pasteur Monument Committee of the United States. The latter committee has issued an announcement from which the following extract is taken:

"We believe it is unnecessary to urge anyone to subscribe. The contributions of Pasteur to science and to the cause of humanity were so extraordinary and are so well known and so thoroughly appreciated in America that our people only need the opportunity in order to demonstrate their deep interest.

"All can unite in honoring Pasteur. He was such an enthusiastic investigator, so simple, so modest, so lovable, and yet so earnest, so great, so successful—his ideals were so high and his efforts to ameliorate the condition of humanity were so untiring that we anticipate an enthusiastic response from the whole civilized world. The United States will vie with the foremost of nations in this tribute. Chemists, zoölogists, physicians, and all others interested in science will wish to be represented. No one is expected to subscribe an amount so large that it will detract in the least from the pleasure of giving. A large number of small subscriptions freely contributed and showing the popular appreciation of this eminent Frenchman is what we most desire. . . .

"It is our purpose to do our work as largely as possible through societies or other organizations. We prefer to have each organization appoint one of its members as an associate member of this committee, with authorization to collect and forward the subscriptions. The amounts thus far subscribed by individuals vary from fifty (50) cents to ten (10) dollars. It is hoped that no one who is interested will hesitate to place his name upon the list because he can not give the maximum amount."

The committee will supply subscription blanks and receive and transmit the funds which are raised. Remittances may be made to the secretary, Dr. E. A. de Schweinitz, Cosmos Club, Washington, D. C. All checks, etc., should be made payable to "Treasurer, Pasteur Monument Committee." The original subscription papers will be forwarded to the Paris committee for preservation.

EXPERIMENT STATION RECORD.

VOL. VII. No. 12.

The present number completes the seventh volume of the Record. The character and extent of the work in this and the preceding volume is indicated by the following table:

	Volume VI.	Volume VII.
Station reports	42	46
Station bulletins	295	304
Publications of United States Department of Agriculture	78	83
Foreign articles	526	443
Total number of articles	1,606	1,301
Classified as follows.		
Physics	....	1
Chemistry	96	144
Botany	53	43
Fermentation and bacteriology	1	4
Zoölogy	4	10
Meteorology	86	54
Air, water, and soil	87	54
Fertilizers	95	100
Field crops	398	206
Horticulture	155	111
Forestry	22	11
Seeds and weeds	37	41
Diseases of plants	110	64
Entomology	99	87
Foods and animal production	182	156
Veterinary science	62	36
Dairying	113	75
Technology	6	7
Agricultural engineering	32	18
Statistics	65	76
Miscellaneous	....	1

The abstracts in this volume occupy 646 pages, and required in their preparation the reviewing of 25,281 pages in the original publications. In addition to this the volume contains 3,256 foreign titles, not abstracted; 15 editorials, occupying 27 pages; 11 special articles occupying 120 pages, and 88 station notes, occupying 14 pages.

As in previous volumes, the subject index has been made in sufficient detail to serve as a fairly complete guide to the contents of the publications abstracted.

INDEX OF NAMES.

INDEX OF SUBJECTS.